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POPULAR MECHANICS

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SEE PAGE I

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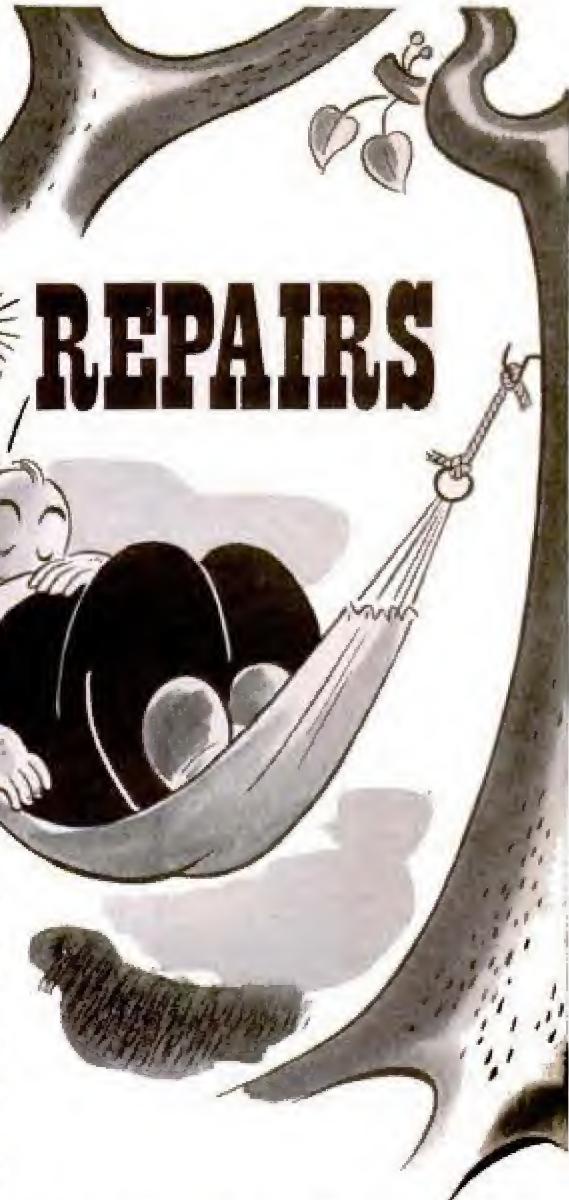
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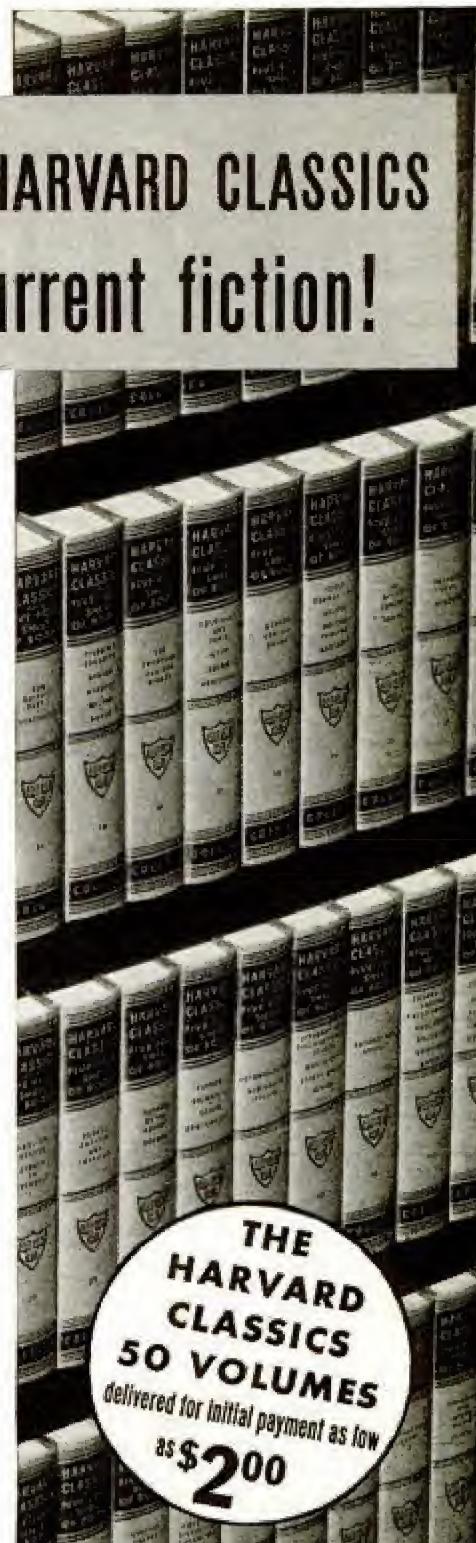
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February, 1942

Vol. 77, No. 2

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Tomorrow's Plane Takes Shape

ALREADY riding American skies are the largest and probably the fastest airplanes in the world. On the drawing boards are planes that will dive as fast as sound, interceptors that will better seven miles a minute. By spring, Lockheed hopes to test-fly transports for U. S. air lines that will carry 64 passengers at 300 miles an hour, the thin air 30,000 feet up their element. No fanciful tale, this, but facts up-to-the-minute. You'll read it in March: a story of new wings, new engines, new planes of '42.

Building the "Liberty" Fleet

HEY thought the pace of ship construction in world war days would never be equaled. Vessels were launched six months after keels were laid; but those records are too slow for us. The new "Liberty" ships will slide into water three or four months after they begin to take shape! An article next month pictures for you our gigantic shipbuilding program.

Next Month

YOU are a victim of color. Or a beneficiary. Tea rooms use it to whet your appetite, slow your departure. Blue-green walls, green sawdust floors of packing houses accentuate the redness of meat in the showcases and increase sales. By suitable use of red, the boss can get more muscular activity out of you. In the hospital, yellow walls cheer on your recovery. For a good look at what they're doing to you with color, see the March Coloroto story: "Color at Work," with its eight pages of pictures in color.

Submarine Sailors

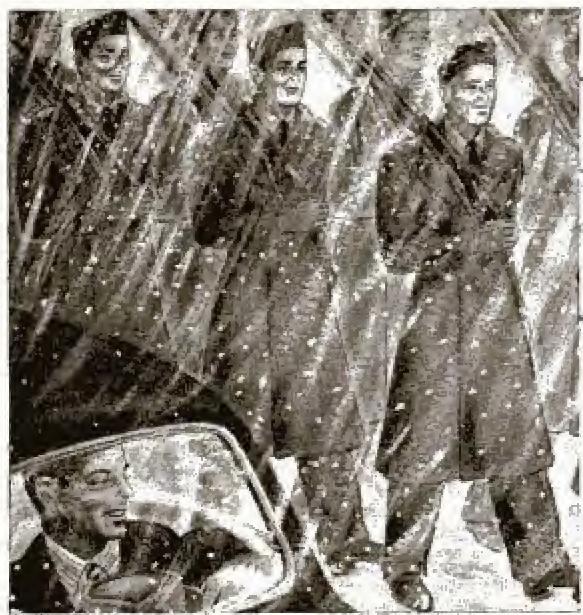
IF YOU like the reek of hot Diesel oil and the acrid fumes of batteries, if you can "take" the smothering sensation of artificial lungs in a deep-sea escape and the stabbing pain of 50 pounds compression, if you've a stomach of steel and a shatterproof temper and the clear brain and courageous heart you'll need in emergencies, you may qualify for the submarine service. Read "Super Sailors for the Subs" next month.

The Battle for Safety

GENERAL Carelessness is leading a blitzkrieg exacting close to 20,000 lives a year in our factories. Industrial safety has become an industry itself. A March story tells of new developments on this front: electric eyes and wire "handcuffs" to shut off dangerous machines, waterfalls that curtain dust, weird "Martian" uniforms. Here's a war being won.

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Where no name and address appear directly under an item, the product is not believed by us to be commercially available

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DEATH WAILED THROUGH THE HIDEOUS NIGHT!



A true experience of HENRY STERGER, Fisher, Minn.



"SOON WAIST-HIGH drifts forced us to abandon the car a half a mile from home. As our feet touched the ground the wind kited us into a ditch 100 feet away. Dazed, bruised and nearly frozen, we struggled to our feet. I reached for my flashlight and with the aid of its steady beam, now stumbling, now falling, now rising, we inched along through the awful night."



"NUMB WITH COLD, more dead than alive, we at last fought our way to a farm building—our granary. Inside the granary, by means of the flashlight, I found an old hay knife, with which I cut enough wood to build a fire. Huddled close to its life-giving warmth, we weathered the blizzard. Beyond question of a doubt we are alive today because of our 'Eveready' flashlight and its dependable *fresh DATED* batteries. (Signed) *Henry Sterger*"

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and

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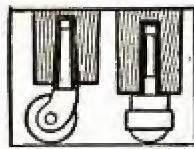
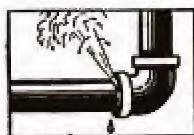
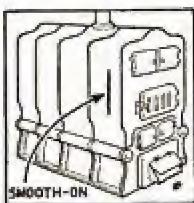
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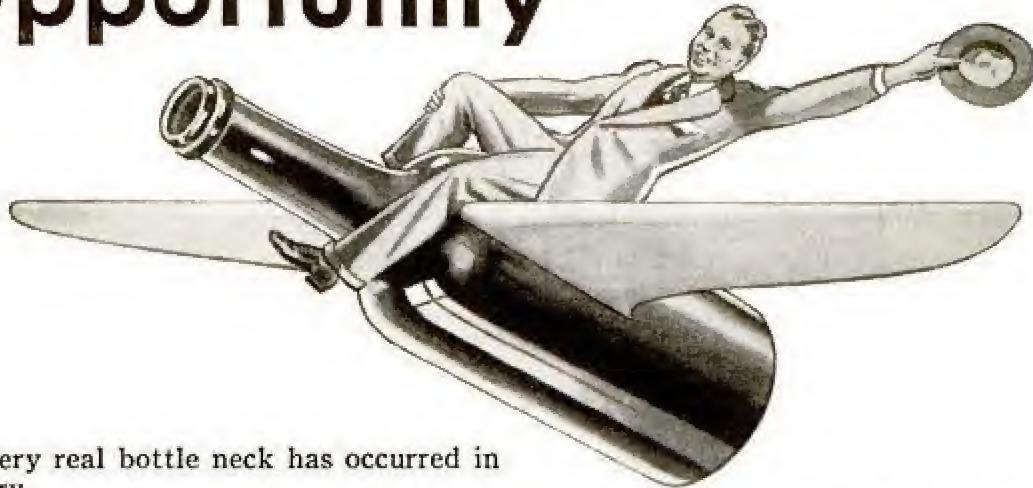
Do it with SMOOTH-ON

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This Bottle Neck is Your Opportunity



A very real bottle neck has occurred in industry.

The millions of men going to work in the defense industry and business boom need thousands—hundreds of thousands—of supervisors and executives. Expanding Government agencies are calling for many specialists. Regular business needs experts to take care of expansion and to replace men called to military service.

The need is for all sorts of executives and specialists—foremen, supervisors, superintendents, accountants, traffic men, tax experts, time keepers, department managers, auditors, cost experts, production men, etc. The need will grow and continue for years to come.

There just are not enough men ready for these places nor can industry take the time to train them. Thousands—scores of thousands—must get their own training.

That is your opportunity—if you are ready or will get ready quickly. Never again will you have such an opportunity to command the success you want. But you must act decisively—immediately. The more quickly you get ready,

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OIL**



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Where will you be 11 months ~~ONLY~~ FROM TODAY?

• This is the year you were going to get out of that rut — remember? The year you were going to do something about making progress in your work, and increasing your income. Yet here's one whole month gone by, and you're still marking time.

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| <input type="checkbox"/> Architectural Drafting | <input type="checkbox"/> Electrical Drafting | <input type="checkbox"/> Mine Foreman | <input type="checkbox"/> Shiplifting | <input type="checkbox"/> Shop Practice |
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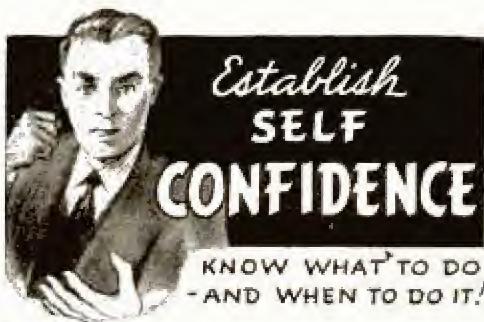
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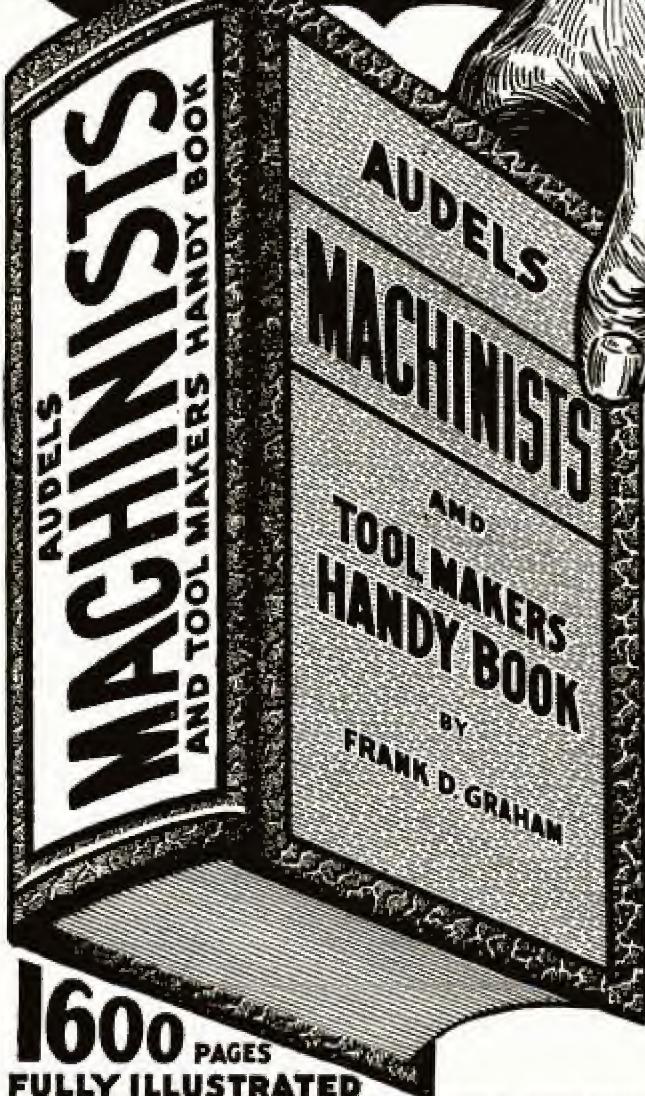
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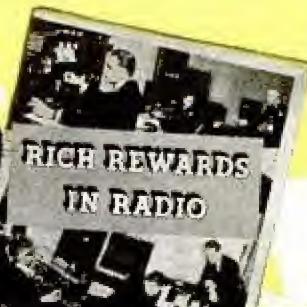


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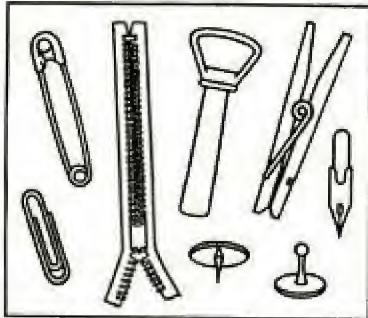
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(More Popular Inventions on page 52A)

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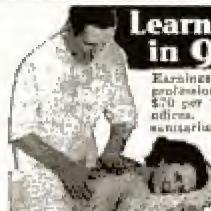
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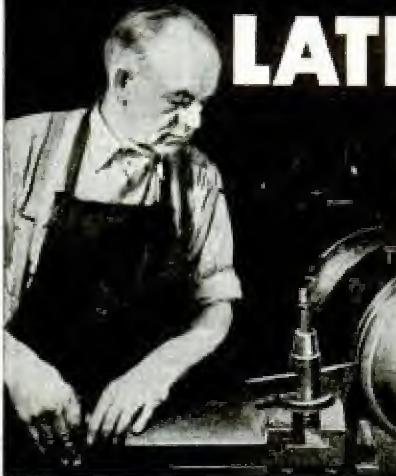
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| <input type="checkbox"/> Aviation Mechanic | <input type="checkbox"/> Highway Engineering | <input type="checkbox"/> Public Works Engineering | <input type="checkbox"/> Structural Drafting |
| <input type="checkbox"/> Boilermaking | <input type="checkbox"/> House Planning | <input type="checkbox"/> Pulp and Paper Making | <input type="checkbox"/> Structural Engineering |
| <input type="checkbox"/> Bridge Engineering | <input type="checkbox"/> Industrial Metallurgy | <input type="checkbox"/> Radio, General | <input type="checkbox"/> Surveying and Mapping |
| <input type="checkbox"/> Chemistry | <input type="checkbox"/> Locomotive Engineer | <input type="checkbox"/> Radio Operating | <input type="checkbox"/> Telegraph Engineering |
| <input type="checkbox"/> Civil Engineering | <input type="checkbox"/> Machinist | <input type="checkbox"/> Radio Servicing | <input type="checkbox"/> Telephone Work |
| <input type="checkbox"/> Coal Mining | <input type="checkbox"/> Management of Inventions | <input type="checkbox"/> R. R. Section Foreman | <input type="checkbox"/> Tarnishing |
| <input type="checkbox"/> Concrete Engineering | | <input type="checkbox"/> R. R. Signaller | <input type="checkbox"/> Refrigeration |
| | | <input type="checkbox"/> Sanitary Engineers | <input type="checkbox"/> Welding |
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BUSINESS COURSES

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| <input type="checkbox"/> Accounting | <input type="checkbox"/> Advertising | <input type="checkbox"/> College Preparatory | <input type="checkbox"/> First Year College | <input type="checkbox"/> Railway Postal Clerk |
| <input type="checkbox"/> Bookkeeping | | <input type="checkbox"/> Commercial | <input type="checkbox"/> Foremanship | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Business Correspondence | | <input type="checkbox"/> Commercial Illustrating | <input type="checkbox"/> French | <input type="checkbox"/> Secretarial |
| <input type="checkbox"/> Business Management | | <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> Good English | <input type="checkbox"/> Spanish |
| <input type="checkbox"/> Cartooning | <input type="checkbox"/> Civil Service | <input type="checkbox"/> C. P. Accounting | <input type="checkbox"/> High School | <input type="checkbox"/> Showcard and Sign Lettering |
| | | | <input type="checkbox"/> Managing Men at Work | <input type="checkbox"/> Traffic Management |

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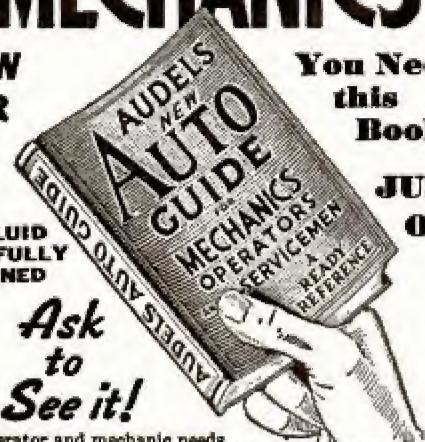
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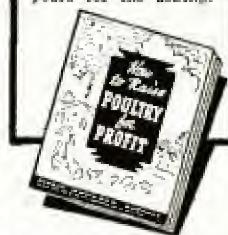
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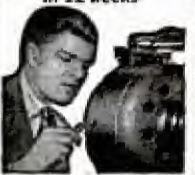
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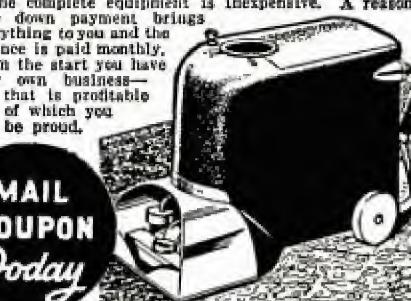
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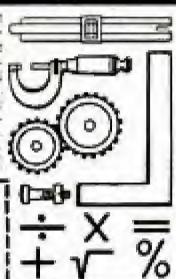
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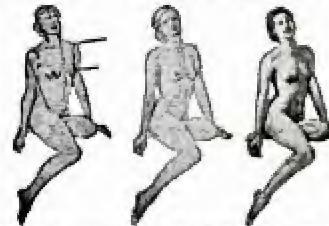
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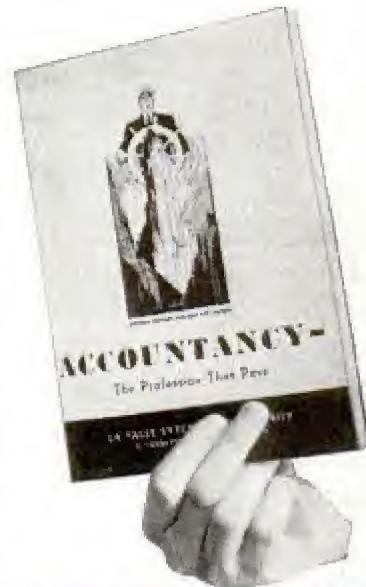
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BRUSH Plating outfit connects to a battery, no tanks necessary. Almost as simple as painting. Your opportunity to make good income plating autoparts, bathroom fixtures, reflectors, mirrors. Get free proof and particulars that put you in a paying business of your own. Gunmetal Co., Ave. H, Decatur, Ill.

HOW And where to obtain capital. Fully explained, particulars free. Star Service, Wapakoneta, Ohio.

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EXTRA Income—Plenty mail selling opportunities. Write Katz, 4254 N. Kimball, Chicago.

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POPCORN And potato chip machines. We help start men and women in business. Long-Ekins, 1960 High, Springfield, Ohio.

COLOR Concrete with chemicals. Wish-wells, stucco-rock. Benches. Spin concrete pottery. Cement artistry. Garden ornaments. Cold glaze. Concrete paints. Marbling. Sample 10c. Hollywood Cement Craft, 8527 Wonderland, Hollywood, Calif.

MAKE Colorized concrete pottery, cemetery products, tiles, floors. Basement waterproofing. Other projects. Booklet, colorplates, details 10c. National Potteries, Minneapolis, Minnesota.

SELL Books by mail on commission. No stock to carry. Orders come to you. Maywood Publishers, 1107 Broadway, New York.

LIQUID Marble—Colorful, glazed! Mold, brush, spray! Composition floors, rubberlastic molds. Particulars free. Marbleizing Service, Edwardsville, Illinois.

OPPORTUNITIES For local and mail order business. Gilbert Supplies, 5 West 24th, New York.

CHARTERS: Delaware; best, cheapest; free forms. Colonial Charter Co., Wilmington, Del.

ELITE Collection of business plans, contains 127 tested plans and scores of formulas. Start own business; home, office. Particulars free. Elite Co., 214 Grand St., New York.

WHERE To buy at lowest wholesale prices. Information free. Yorena, Box 312, Bayonne, N. J.

127 WAYS To make money, in home or office, business of your own. Full particulars free. Elite Co., 214 Grand St., New York.

MAKE Money by mail, the way we do. Free information. Maywood, P-1107 Broadway, New York.

SWISS Music box works—\$1.25 to \$2.10. Suitable for many novelties. Mermel Manufacturers, 147 West 46th Street, New York.

YOUR Ad in this space will bring amazing results. I'll prove it to you. Write at once for interesting information. F. W. Johnson, Room 300, 200 East Ontario St., Chicago.

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START Your own magazine agency at home. No capital required. Write for particulars and supplies. American Readers' Service, Hatfield, Penna.

FREE—200 Clever mailorder, homework, local business offers—all snappy money-makers. Lewis Co., 828-M Carpenter, Oak Park, Ill.

2c DAILY Pays for New York office under your own name. Co-Operative Offices, 126 Lexington Avenue, New York.

MAKE Beautiful glass and illuminated signs, mirrors, emblems, picture mounts. Cheney Sign System, Park Ridge, Ill.

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SPECIALTY Manufacturing — 1000% profit! Formulas especially designed small businesses. Little capital, no machinery. Brochure free! Victor C. Race, Norwalk, Connecticut.

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PHILADELPHIA Business address. Mail receiving, forwarding. Graham System, Real Estate Trust Bldg.

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BIG Uniform manufacturer seeks man to contract restaurants, beauticians, doctors, nurses, factories, offices, homes, others. Offer exclusive, patented styles; unsurpassed workmanship. Leads furnished. Permanent. Outfit free. Hoover, 251 W. 19th, Dept. AL-10C, New York City.

AT HOME, your own manufacturing business, making popular \$1 novelties. Cost 5c to 15c. Everything supplied. Write So-Lo Works, Dept. F-842, Cincinnati, Ohio.

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RELIABLE Man or woman wanted to call on farmers. Some making \$100.00 in a week. Experience unnecessary. Write McNess Company, Dept. 580, Freeport, Ill.

AGENTS WANTED

SELL Nylon hosiery and famous snag-protected silk hosiery. Sensational profit opportunity. Write fully for free selling outfit. American Mills, Dept. G-198, Indianapolis, Indiana.

I WILL Give you \$5.00 worth full size packages foods, groceries, soap, etc., free if you agree to show friends and others. Amazing spare time money making opportunity. Write Zanol, 6239 Monmouth, Cincinnati, Ohio.

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WRITE For free fabric samples amazing stainproof tablecloths. Clean with damp cloth. Require no ironing. Beautiful patterns. Look expensive, long wearing, low priced. Commissions big. Also complete dress line. Melville Company, Dept. 3130, Cincinnati, Ohio.

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CALL On friends with greeting card assortments: Easter, birthday, other occasions. Personal stationery; gift wrappings. Big profits. Experience unnecessary. Samples on approval. Wallace Brown, 225 Fifth Avenue, Dept. H-34, New York.

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CALL On dairies. Sales repeat monthly. Carleton Sales, East Hartford, Conn.

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FREE Water and our concentrates make 72 products. We supply labels, bottles. Enormous profits. Qualeco, E-2030 Rusell, Detroit.

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AGENTS—Silk and Nylon hosiery. Big stock; complete line all sizes. Selling like wild. Whirlwind profit opportunity. Replacement guaranteed. Your own hose free with large outfit. Rush hose size, name today. Wilknit, Desk CB-31, Greenfield, Ohio.

HAND Cleaner—Youse, paste, grit. Big profit. Larkin Soap Co., Teaneck, N. J.

ENGRAVED Name plates, numbers, signs, etc., easily sold, profits large. Brett Bros., Winthrop, Mass.

AGENTS, Salesmen, Distributors. 150%-200% profit. New 10c collar support every man needs. Sells direct and to stores. Details free, sample 10c, 20 postpaid \$1.00. Hawkins, Specialty Co., 537 So. Dearborn, Chicago.

50% COMMISSION. Guaranteed men-tions. Prices defy competition. No investment. Commission daily. Exclusive territory. Minelich Monuments, St. Cloud, Minn.

FREE Sample plan, plus simple demonstration, results in big profits to you. Housewives, automobile dealers, hotels, can't pass it up. Make up to \$4.00 each sale. Hurry! O-So-Clean Products, 3007 Natchez, Chicago.

15 FAST Sellers. Big profits. Samples 10c. Box 120M, Arkansas, Wis.

POLMET Polishing cloth removes tarnish from metals without liquid, paste or powder. Agents say sells like "hot cakes." Retail 20c. Small sample free. Gale, Inc., 15 Edinboro St., Boston, Mass.

SELL Rayo Balm for colds, headaches, rheumatics. Herbs, vitamins for health. 5 samples free. Rayo Chemical Corp., 334 Union Avenue, Brooklyn, New York.

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START Life-time repeat business on \$5.00. \$1.00 profit on \$1.20 sale. Millions waiting. Free offer. Thermoflif, Peoria, Ill.

EARN \$10-\$15 Daily applying beautiful, goldlike sign letters. Cost 1c. Sell for 25c. Free samples. Hurry! Modernistic, B-300 Lincoln Ave., Chicago.

SCHOOL Seniors—Sell graduation cards. America's largest, fastest-selling, low-priced display. 35% commission. Free cards. Universal Engraving & Printing, Box 745-M, Pittsburgh, Penna.

CASH IN on defense program. New low priced seller. Splendid profit. Write Henry Krch, Haddon Heights, New Jersey.

KNIT For defense. Auto-knitter machine makes pair military socks hourly. Also mufflers, caps, mittens. Demonstrate in department stores, relief agencies, knitting groups. Write for proposition. Ainslie Knitting Machine Co., 750 Grand St., Brooklyn, N. Y.

DEFENSE Workers. Defend your hands with chapterless, grilleless handspans. Trial size quarter. T. L. DeCamp, Sta. "A," Cincinnati, Ohio.

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AMAZING Cleaner! Makes cleaning easy. Premium deals gets orders. Free sample. Zimco, 5007 Irving Park, Chicago.

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GAS Stations want this new patented necessity. Knipp, Long Beach, California.

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AGENTS—To sell our literature. Good profits. Home business. Maywood, 1105-1107 Broadway, New York.

BIG Money applying initials on automobiles. Easiest thing today. Free samples. If you sell printing and advertising specialties we have an excellent sideline featuring Decalomania name plates in small quantities. "Ralgo," 727 Atlantic Ave., Boston, Mass.

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SOMETHING New in fire extinguishers. Red Comet authentic safety sprays. Real fire killers. Low price. Salesmen needed. Splendid outfit furnished. Write today to Red Comet, 704 Comet Building, Littleton, Colorado.

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STA-ON Transfer labels for photographic solutions are water proof and permanent. 10¢ per package. No stamps accepted. Colonial Press, Attleboro, Mass.

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5000 6x9 CIRCULARS, \$8.25; 5000 elegant envelope slips, \$3.75. All printing low prices. Samples. Goodprint, Harrisonburg, Va.

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1000 BUSINESS Cards \$1.50, embossed \$1.75. 1000 letterheads, statements \$1.95 each. Standard Printing, Fairmont, West Va.

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MIMEOGRAPHING—Prompt service. Excellent work. Samples. Raymond Schwarting, South Amana, Iowa.

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100 8¹/₂x11 LETTERHEADS. 100 Envelopes. (Finest quality.) \$1.35. Sakkens, Holland, Mich.

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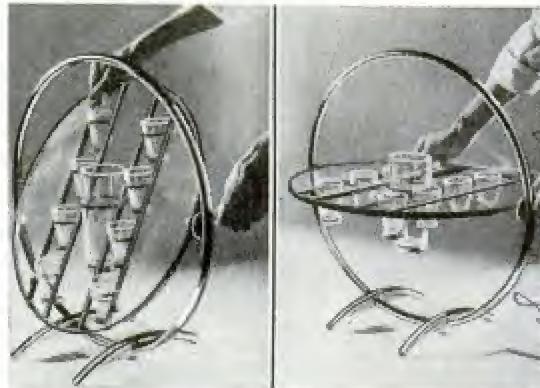
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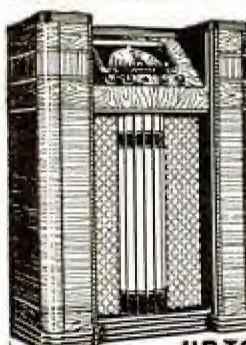
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Thousands of welders have already left their jobs and shops to get "wartime" pay in plants devoted to defense production, such as ship building, tanks, airplanes, munitions, etc. Also, in the erection of industrial plants, bridge construction work, etc. This creates an unusual opportunity for men everywhere to get in the welding business right in their own communities, and take over the work these men have left behind. No special training is required, for now with the new DYNAMIC Super-Charged Transformer-Type Welder that works off a 110 volt electric light circuit, men without previous experience, by following the simple, concise home instructions can quickly do finished repair jobs. In this way you may fit yourself to qualify for a big pay job in the defense industry.

**WELDS BUMPERS, FENDERS,
CYLINDER BLOCKS, BODIES,
FRAMES, ETC. Does Farm,
Factory and Home Repairs**

Many welders make as much as \$15 to \$20 a day. Repair jobs that can be done in less than an hour can make as much as \$5.00. Any number of jobs can be done more efficiently with welding. The DYNAMIC Super-Charged Welder, despite its serviceability, is so easily portable it can be carried around by hand and taken right to the job. This is an added feature whose value you will appreciate once you are in welding.

**WORKS ON IRON
STEEL, TIN, BRASS, COPPER,
AND ALL OTHER METALS**

With this Welder you can work on all kinds of metal—nothing will stump you—you can tackle anything and in no time at all you will be able to do finished repair jobs that will do credit to an expert.

**DOES METALLIC AND
CARBON ARC WELDING**

Can be used efficiently on both types of welding. The cost of using the DYNAMIC Super-Charged Welder is amazingly low. You can do an hour's work on your Dynamic Welder for practically unknown—year'll never have to worry about them. It cools so efficiently that you can use it continuously without ever having to stop in the midst of a job to let it cool down. COSTS LESS THAN 6¢ A DAY. You can buy the DYNAMIC Super-Charged Welder on easy payments. Over a year's time, it would cost you less than 6¢ a day. Once you have your DYNAMIC outfit, you are all set in a profitable

READ WHAT USERS SAY

Electrician says: "It is the best welding outfit." I wish to tell you that I demonstrated your welding outfit to great many people, and they all agreed with me that it did the greatest welding job they ever saw. A. L. Bristol, Conn.

Mechanic Praises Welder

I have received my welder and like it very much. I am a mechanic and electrician by trade, so I can appreciate its usefulness to others. P. C. Perry, N. Y.

Repair Shop Owner Praises About Dynamic

I want to tell you I operate a repair garage and I am more than satisfied with the welder. It will do more than you say. C. P. Butler, Ohio.

Greatest Portable Outfit

I must say it's the greatest portable outfit any man could wish to own. You may put one on file as booster. W. J. B., St. John, N. B., Canada.

AGENTS WANTED: Do you want something easy to sell? You can make big profits introducing the new DYNAMIC Super-Charged Welder—we'll let you try it for ten days at our risk so you can be convinced of the immense sales possibilities. Get our big profit plan and ten day trial offer. Just send attached coupon for free particulars today!

DYNAMIC WELDER CO.

2226-TC SILVERTON ROAD

CHICAGO, ILL.

for Only
\$1975

EASY PAYMENTS



These pictures show how easy it is to operate the Dynamic Super-Charged Welder.



Dynamic Welder Co., 2226-TC Silverton Rd., Chicago, Ill.

Gentlemen: I want to go into the welding business. Send me free particulars on how I can learn welding at home and full details on your Dynamic Welder.

AGENTS: Just mark an "X" here □ and you will receive full particulars of our big profit plan and 10 day trial offer.

Name.....

Address.....

Town..... State.....

WONDERS OF AMERICA

Sky Hotel



MT. EVANS, COLORADO



I HEAR IT WAS BUILT ENTIRELY BY HAND

PHEW! SOME OF THE GRANITE SLABS IN THOSE WALLS WEIGH 5 TONS APIECE



IN RECENT LABORATORY "SMOKING BOWL" TESTS,
PRINCE ALBERT BURNED

86 DEGREES COOLER

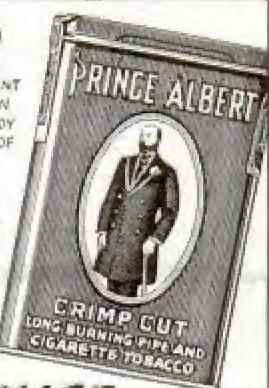
THAN THE AVERAGE OF THE 30 OTHER OF THE LARGEST-SELLING BRANDS TESTED - COOLEST OF ALL!



SUMMIT LAKE

50 PIPEFULS OF FRAGRANT TOBACCO IN EVERY HANDY POCKET TIN OF PRINCE ALBERT

R. J. REYNOLDS
TOBACCO CO.
WINSTON-SALEM
N.C.



PRINCE ALBERT THE NATIONAL JOY SMOKE

Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE AND CANADA

WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 77

FEBRUARY, 1942

No. 2



Garbed in fantastic aluminum helmets and heavy fleece-lined horse-leather suits, cold-room workers test hydraulic control system to find how it would work in the high altitudes

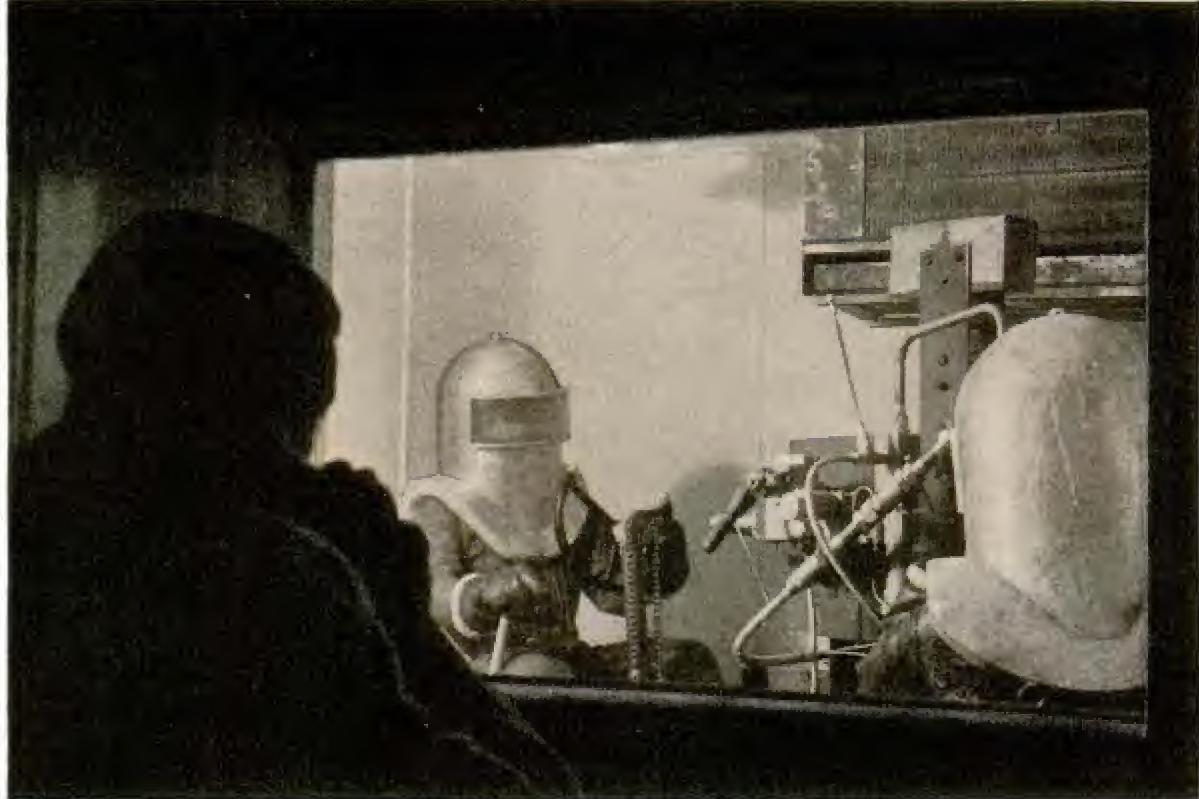
A MERICAN Boeing-built Flying Fortresses that bomb from the upper limits of the troposphere are revolutionizing aerial warfare in Europe. Bombs are dropping from the blue sky, from airplanes so high that they are nearly out of sight and hearing of ground observers.

From 30,000 feet a battleship looks the size of a pinhead. For even larger targets the bombardier six miles up must squint through a telescope to find his mark. Yet at such altitudes the Flying Fortresses are carrying more bombs faster, farther and more safely and are dropping them more

FEBRUARY, 1942

Ref: Harold Mansfield
Public Relations Manager
Boeing Aircraft Co., Seattle Wash.

21197



Outside "safety" man in telephonic communication with inside experimenters is constantly on watch through four-paned, fogless window to prevent accidents in the test chamber

accurately than can low-flying airplanes of more limited performance. American designers who have been laughed at by foreign experts for going to "unnecessary heights" are now being vindicated.

Having pushed the war up to 30,000 feet the same American designers are now striving for effective operation at the 35,000- and 40,000-foot levels. The battle zone of the future, they believe, may ultimately climb to 50,000 or 60,000 feet, ten miles or more above the earth.

At such heights the aviators may wear queer-looking lightweight pressure suits and helmets. Breathing oxygen, they will talk in high squeaky voices into their radios. They may have to learn new ways to fight, because airplanes, bullets, and bombs all operate strangely in the cold, thin air.

The advantages of high flight, aside from operating economies and extra speed, are many. A bomber, for instance, is above most of the weather and thus becomes a steady platform for accurate bomb sighting. Antiaircraft fire is extremely inaccurate even at present ceilings. Not many pursuit planes can climb as high as the altitudes at which the Flying Fortresses now operate.

On the other hand the standard temperature at 35,000 feet is 67 degrees below zero. Air pressure is 3.45 pounds per square inch, less than a quarter of the pressure at sea level. There is not enough oxygen to sustain life. All sorts of troubles related to



Pilot in low-pressure "strato chamber" writing down his reactions in test

L119 7



these conditions had to be vanquished before 30,000-foot operation became dependable. The same problems are worse at 35,000 feet, the next step up.

For one thing, the moisture of the pilot's breath condenses on the windows and freezes. Double windows, heated and unheated, are being tried out. The lowered air density makes the engine ignition faulty at these altitudes. Ignition systems may have to be enclosed in a special casing that contains air under pressure. Electrical effects at high altitudes produce static that interferes with radio operation.

The intense cold shrinks an airplane so much that the camouflage paint is loosened and sheds like dandruff on its return to the earth. Rubber de-icer boots turn brittle and crack to pieces. For safety, all such fittings are being replaced with a new composition that doesn't

Above, interior of altitude pressure chamber with which conditions at 55,000 feet can be simulated without leaving ground. Top, left, high-altitude oxygen mask, developed through army and cold-room tests, is now standard equipment for actual flights



Above, Douglas Cameraman Larry Kronquist emerging from cold room after making several of the photos illustrating this story. Left, crew members "supercharged" on ground, enter Flying Fortress where they will connect oxygen lines to plane's tanks



8 1947



Outside control panel for altitude chambers with operator talking to pilot inside. One chamber also is connected to the cold room

↓



↑
Latest version of the Boeing Flying Fortress showing upper, lower and forward and rear gun emplacements; it is intended for high flying



become brittle in the cold. Ball bearings freeze up in their grease, the greased controls stiffen and resist the pilots, and even oil in the propeller domes becomes stiff. The needles on the engine oil-pressure indicators slowly drop even though the oil pressure is normal. This confuses the pilots. Fluid in the hydraulic systems isn't affected at the temperatures so far encountered but new formulas for most of the other oils and greases used for high flying must be worked out. All the materials in the planes not only must function normally in extreme cold but through a temperature range of 150 degrees as well.

Engine operation is possible because of the development of the positive turbo-supercharger that is driven by the discharge of engine gases and that packs the thin air into the carburetors. Given the chance, gasoline would boil away slowly into gas in the tanks at high altitude. Boosting the pressure

Pilot being helped from cold compression chamber. In flight, heated cockpit makes this heavy suit unnecessary

L119 7

L1268

in the tanks, plus using oversize lines, is necessary. Likewise the fuel lines must make long smooth bends instead of sharp turns in going around corners. The fuel tends to vapor lock at sharp corners.

To help solve these problems, the flight and aerodynamics departments at Boeing Aircraft Company in Seattle are making test flights with full crews up to 35,000 feet. Conditions at this altitude are so critical that extra oxygen masks, with oxygen constantly flowing through them, are placed in the cabin for instant emergency use in case a crew member happens to kink or break the line to the mask he is using.

Boeing's new B-17E, the latest model of the Flying Fortress series and larger and more deadly than its predecessors, is now in mass production. The plane has power gun turrets in the roof and floor of the fuselage and a gun turret in the tail as well. Tail surfaces are extremely large to provide more stability, just as desirable in a bomber as in a passenger transport.

Boeing, and other manufacturers such as Douglas, are carrying on a great deal of their stratosphere research right on the ground. Test flights cost around \$1,000 an hour for flying time, so much research is done instead in big pressure chambers from which the air is exhausted to produce the same partial vacuum that exists at high altitudes. Low pressures simulating altitudes of up to 60,000 feet can be manufactured. Likewise, cold rooms are used in which the temperature can be dropped to minus 70 degrees or more. Boeing has built a combination cold and "strato" chamber, covered with a 12-inch cork sheathing, in which both pressure and temperature can be dropped to reproduce the exact conditions that exist aloft.

The Boeing cold room is large enough to test a full sized tail group control system, for example. In the Douglas cold room the research men wear horsehide and wool suits surmounted with aluminum helmets that are equipped with nonfogging Plexiglass windows and interior telephones. To avoid catching pneumonia the men breathe air that is warmed by their own bodies and that exhausts through valves in their helmets. One man never works in the sub-zero icebox alone and there is always an observer outside the chamber, watching through a quadruple plate-glass window.

Along with the study of how materials

(Continued to page 192)

Dog With Radio Set on Back ✓ Obeys Distant Master



This radio equipment permits remote control of dog

Apparel for war dogs of the future will doubtless be a harness-pack housing a radio receiver and headphones. A dog so equipped was exhibited by Carl Spitz, trainer of dogs, at the Los Angeles Kennel Club dog show. It is said that with a short-wave receiver on his back, a dog can be controlled within a radius of three miles under adverse battlefield conditions.

L1240

Liquid Dispenser for Sauce Bottle ✓ Serves an Ounce at a Time

Made to fit snugly on most sauce bottles, a syphon server delivers small uniform servings of fruit juice, salad dressing or olive oil from the bottle by pressure on a plunger. It is a timesaver in the kitchen when preparing several dishes of salad, since there is no danger of "flooding" any one dish. The plunger in "up" position seals the bottle.



U. S. railroads operate 75,000 miles of daily mile-a-minute or faster trains.

Railway Age. 1/22/4.

L 10 78.

Coil for Fluorescent Lamp Corrects Color of Light



Colored plastic coils slide easily on tubular light

New effects in fluorescent lighting can be obtained by slipping colored coils of translucent plastic over the tubular lamps. Covering the whole tube, the springlike coil controls its brilliance, corrects color distortion and may be used for decorative purposes alone. Best results are obtained with coils made of red and clear strands of Tenite plastic wound together. Red helps make up for the deficiency of that color in white and daylight fluorescent lamps. Pink coils act as diffusers, passing more than 70 percent of the light, and also aid in correcting color distortion.

L 12 13

Flashlight With Rubber Case Resists Water and Shock

Completely insulated in a watertight rubber case molded in one piece, a flashlight designed for hard wear may be



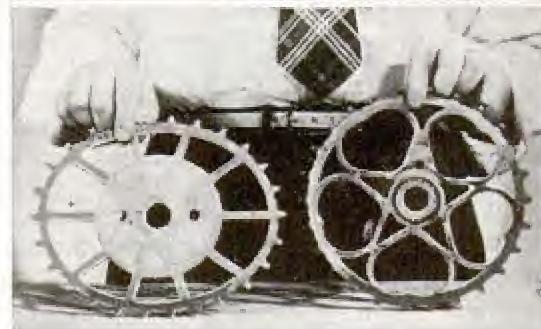
Rubber case, top, guards flashlight against damage

dropped on hard pavement from six stories or left in water three months and still work. It is safe for use near electric wires, cannot be magnetized and is not affected by change in temperature. The shatterproof plastic lens throws a clean, long-range spot from an aluminum-plated reflector. A side-opening feature for easy removal of batteries prevents corroded batteries from sticking permanently. Switch problems are avoided with a patented two-button snap switch. The flashlight is made in two-cell and three-cell sizes, with either fixed or adjustable focus.

L 12 43

Oval-Shaped Sprocket for Bicycle Takes Less Pedaling Effort

More power, quicker pickup and greater speed with less energy on the part of the rider are claimed for an oval-shaped "easy



Oval bike sprocket compared with standard type

pedaling sprocket." The pedals extend from the elongated end of the oval, which is said to give added leverage on the downward thrust, of special help when pushing against heavy headwinds. The new sprocket does not increase the number of gear teeth or change the ratio.

To learn where to buy commercial products described in these pages, see the index.

1/192.

British Paint Grim Faces on American Planes

When American Tomahawk fighting planes arrive in Africa, British artists paint them with fierce faces to match their relentless power. The contour of the fuselage lends itself most readily to transformation into the likeness of a man-eating shark poised for attack upon its prey.

The vicious grin of a man-eating shark is the fighting face painted by men of the British R.A.F. on Tomahawk pursuit planes made by Curtiss-Wright corporation and shipped to Africa



Acme

1/143

Frozen Food Delivered at the Door by Refrigerated Truck

Frozen food products can be delivered direct to homes with a special refrigerated

motor truck, permitting the wholesaler to serve consumers on regularly established routes. Food may be preserved indefinitely in two compartments, each containing four freezing cylinders, mounted one on each side of the truck with a catwalk between them. Beneath each battery of cold cylinders is a one-horsepower gasoline compressor that maintains sub-zero temperatures. Compressor units are inexpensive to operate, easy to start and accessible for service. The trucks are made in two sizes, one containing 77 cubic feet of payload space, and the smaller unit having a 36 cubic foot capacity.



Housewives receive frozen foods direct from refrigerated truck

1/207

Welded Steel "Igloo" Like an Eggshell Has No Beams or Supports

Shaped like an egg, a steel "igloo," completed for use as a lunchroom and recreation parlor for employes of Chicago Bridge and Iron Company of Chicago, is without beams or supports of any kind. The entire structure is made of "dished" plates only $\frac{3}{16}$ -inch thick, which were welded together piece by piece on the job. It is 108 feet in diameter and 28 feet high. The air-conditioned building has no windows, and is fireproof, soundproof and heatproof.



No beams or supports are needed in this shell-like structure

Acme

2/22/21

Leggett



Lighter-than-air craft, including five barrage balloons, one new naval airship and two Goodyear blimps

Members of barrage balloon's ground crew hanging sandbags on a balloon at Camp Davis, training center



SWARMS of great, fat "spiders," which float high in the air and dangle webs of steel to entangle enemy warplanes, are being assembled rapidly to protect America's defense bases and harbors, factories, the Panama Canal and other vital spots.

Already found absolutely indispensable in the defense of critical areas across the Atlantic, these spiders are barrage balloons, some of which can rise to 15,000 feet and ride at anchor, tethered to earth by cables that form a dangerous web. An actual hazard—a collision with a cable usually sends a plane to destruction—the big, hydrogen- or helium-inflated bags also create a tremendous mental hazard because they can be moved readily from place to place and the enemy pilot never knows where he will encounter the web. And this fear of striking a cable, particularly at night, forces raiding bombers to fly so high that their

L1221



Here are three striking photographs of barrage balloons and ground crew in action. Above, the crew hauling down a balloon in preparation for bedding it down for the night. Speed in raising and lowering the balloons is highly essential. Upper right, spectacular view of two balloons caught in searchlight beams in night operation at Camp Davis. In this picture the balloons resemble big, white spiders. Bottom, a four-lobe balloon being inflated with helium at Goodyear air station, Wingfoot Lake, near Akron, O. Goodyear is one of several companies making balloons.



FEBRUARY, 1942 Store & Rubber Co. Akron, Ohio

P 1221



Four-fin balloon (above) inflated and ready for ascent after removal from hangar. Below, odd-looking barrage balloon of type being built for the Army by General Tire & Rubber Company



accuracy may be affected.

Hundreds of the balloons are being constructed and thousands of men are being trained to handle them. Responsibility for instructing U. S. Army officers and enlisted personnel in this specialized work lies with the Coast Artillery Corps. Before completion of the permanent training center, Camp Tyson, near Paris, Tenn., where there are facilities for over 7,000 men, a temporary school was conducted for several months at Camp Davis, N. C., with both officers and enlisted men attending six- and 12-week courses and then helping to train others, thus building up a large force to man balloons, trucks, winches and related equipment now coming out of factories in such quantities as to make possible the organization of a large number of battalions.

At Camp Davis balloons 28 feet wide and 85 feet long were used. Classified as 27,000 cubic-foot balloons, they were inflated from small cylinders of helium, with each balloon requiring from 115 to 130 cylinders. Only partly trained crews were found capable of inflating a balloon in less than 30 minutes. Since speed is highly essential in getting the bags into the air to ward off raiding planes, great emphasis was placed on reducing inflation time.

In use as protectors of military objectives, the

Above: Above
Six-fin Strato-Sentinel balloon leaving hangar. It can rise to 15,000 feet

L12 21



Several barrage balloons at low altitude while three Goodyear blimps cruise overhead in recent demonstration

balloons are controlled by gasoline-driven winches, either of the mobile type that can be transported from position to position by truck or of the type designed for mounting permanently on a truck. The balloons can be released "up" or hauled "down" at the rate of 1,000 feet per minute, with the winches unwinding or reeling in the cable on a large spool or drum. Three-sixteenths-inch cable was used on the Camp Davis balloons, which were of a type capable of reaching 7,500 feet.

When the balloons are not supporting their steel web, they are "bedded down"—pulled to earth by the ground crew and staked down. What is known as the balloon bed is a space large enough to bed down an inflated balloon. Preparation of the bed is accomplished by clearing the ground of all obstacles, covering the space

Members of the ground crew at Camp Davis attaching heavy tackle for controlling flight of balloon



(Continued to page 189)

2/12 20

"Kolok"

Control for Antiaircraft Weapon / "Predicts" Position of Plane



Tracer control box aims antiaircraft gun at "predicted" position of plane

In firing from the ground at enemy planes in flight, guns must be aimed at the spot where the ship will be when the projectiles reach the prescribed height. Soldiers of the Coast Artillery antiaircraft unit from Camp Edwards, Mass., are among the military units using a central tracer control box which "anticipates" the position of a plane overhead.

threads so they resist wear. Oddly enough, the microscopic riveting appears to take place at the very points where the threads would be most likely to part. The process also has been applied to underwear, mittens and blankets.

2/13 2

Blazing Magnesium Is Extinguished by ✓ New Powder

Magnesium fires, cause of much of the damage in bombed cities overseas and a bugbear of American defense industries where magnesium alloys are fabricated, are the special business of a new extinguishing powder. Magnesium burns with a brilliant flash which is almost explosive in the presence of water. The new chemical powder, however, is said to quell the fire quickly.

2/13 2

Socks 'Riveted' Chemically Give Longer Wear

Men's woolen socks, given a new treatment which "rivets" them chemically, are reported to last three times as long as untreated socks, and their shrinkage is almost eliminated. The process will be licensed to men's hosiery manufacturers by U. S. Rubber company in whose laboratory it was developed and tests conducted. Fabrics are treated by immersing them in a bath of certain colloidal substances suspended in water. During immersion microscopic particles of the substance, say the chemists, do a job throughout the fabric that may be described as riveting the fibers in the twisted



Powder (left) quells magnesium fire but water spreads flames

Rockefeller Center
1230 6th Ave. New York

6/17 8. Third N. 20th Street

L1269 Glenn L. Martin Co.
Baltimore, Md.

Largest Flying Boat Launched, Named "Mars"



Left wing of aerial battleship tilted toward water after launching because the ship was empty

Ceremonial honors traditionally reserved for surface vessels were bestowed in the christening and launching of the United States Navy's 67-ton Martin patrol bombing plane. Named "Mars" as a bottle of champagne was smashed across its silver

bow, the \$2,500,000 flying warship slid down the ways at Baltimore. Now in the water, the ship, with its wingspread equal to the height of a 20-story building, is being tested. It could carry a bomb load to Europe and return, nonstop.

Rubber Soles With Nonskid Treads Grip Wet Surfaces

Cutting special treads in rubber-bottom shoes has produced a nonslip sole which grips virtually any wet surface. The tread consists of deep crosswise cuts in wavy or zigzag lines. Being close together the cuts permit the rubber to spring open, forming

3,700 individual tentacles, each of which acts like a drying squeegee on wet surfaces and also produces a suction effect that prevents skidding. The sole comes on all kinds of sport shoes and also on boots.



Bending the sole reveals deep-cut, nonskid tread

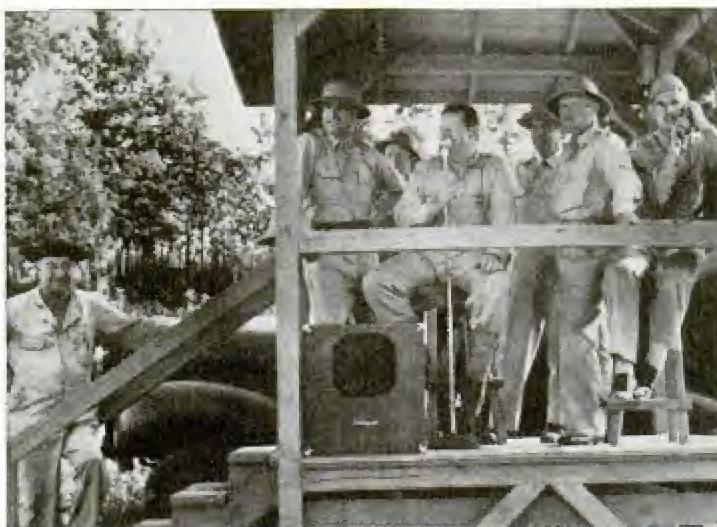
Heat-Resistant "Vanishing Oil" Used in High Temperatures

A "disappearing" oil for use in the extreme temperatures of industrial kilns has been developed by the Standard Oil (New Jersey) Development company. Ordinary oil or grease at temperatures above 400 degrees Fahrenheit would decompose and leave carbon and other solid deposits injurious to bearings. The new disappearing oil vanishes slowly, leaving behind a clean, carbon-free surface. It is used to oil bearings of kiln cars, to coat molds in which molten glass is to be poured, and similar applications. In cases where fresh oil cannot be applied before complete evaporation has occurred, colloidal graphite in the disappearing oil is left in a dust-thin deposit to prevent metal-to-metal contacts until the bearing can be reoiled.

Col. Pvt. Norman W. Modell
2 M3 Co. B 1st Bn Camp Wheeler, Ga.



The arrow points to the target, not much more than a dot on the horizon 700 yards away—but these .50-caliber guns create a danger area 9,500 yards behind the targets. This is what the range looks like to the man behind the anti-tank gun sights



Officers of Company B, 1st Battalion, direct the firing from the control stand as rolling targets move across the range at Camp Wheeler. As the firing orders come from the loudspeaker, tracer bullets start streaming toward three white dots

The 3½ by 6 foot target emerges from behind shield at 5 to 35 miles an hour and gunner must take sight in front of it. At right, he would aim at spot where target now stands at the moment when its nose first appeared from behind wood shield



On the ANTI-TANK FIRING RANGE

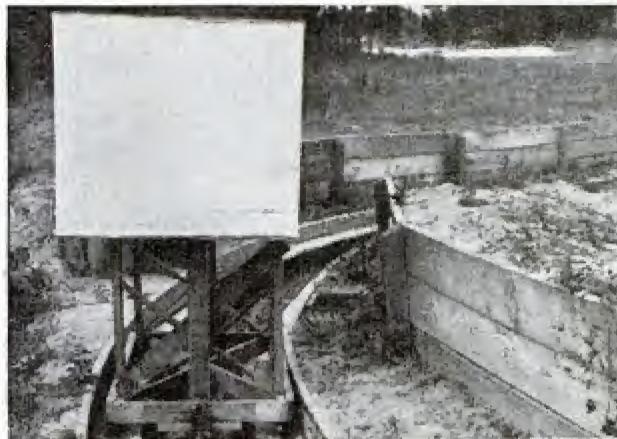
WHILE American tanks endure their baptism of fire on Libyan sands, Uncle Sam's young men are learning how to stop these land battleships to the accompaniment of a terrific tattoo of anti-tank weapons at Camp Wheeler, Georgia. Tracer bullets stream from .50-caliber machine guns to rip through targets that race, crawl and double back unexpectedly on a winding track hundreds of yards distant.

The armored tank has been the Goliath of land warfare in World War II, terrifying to the infantry

L 1193



↑ Fifty-caliber machine guns in foreground are effective against light tanks. Thicker-barreled guns beyond are water-cooled .30-caliber machine guns



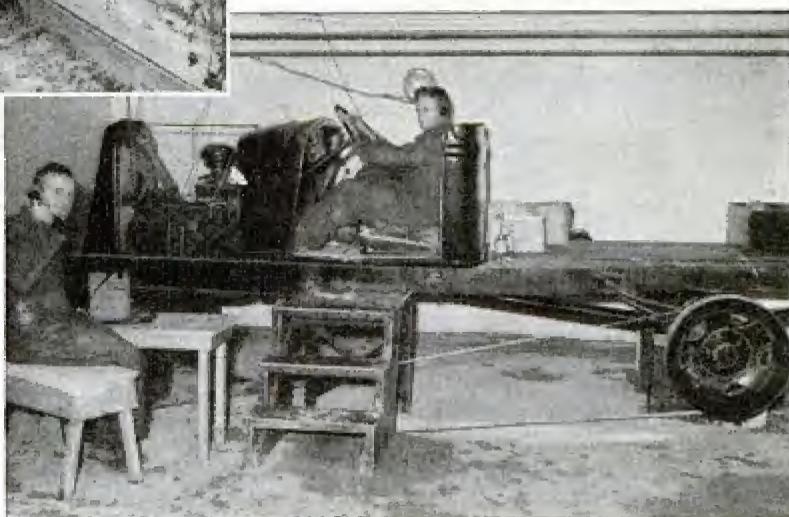
Above, the target carriage rounds a bend in the track, which is three feet wide and a foot deep. The wooden parapet, rising 40 inches above bottom of track, hides carriage from view of gunner

Range soldiers receiving orders from the control stand by telephone operate the old truck which moves the targets back and forth by means of an endless cable, driven by a cable wheel on rear axle

soldier and a destroyer of backline communications. Defense against them is both passive and active. Passive defense is primarily an effort to obstruct their movement or hide from them. The army digs traps, sets up wooden posts to block their advance; soldiers dig "fox holes" in which they hide safely as tanks roll over them.

But the best way to stop a tank is to attack it. This means guns with penetrating fire, capable of biting through several inches of steel, as well as trained personnel to operate them. We have such guns—37

(Continued to page 192)



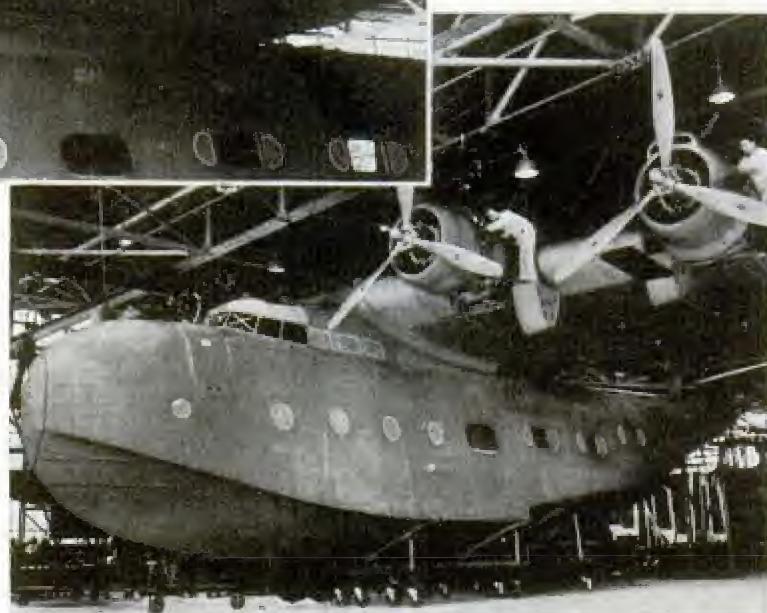
L122

Big Planes to Span Atlantic on Nonstop Flights



Mechanics installing two of the power units that will contribute their share in non-stop crossings of the Atlantic. Propellers have three full-feathering type blades

Eighty-foot flying boat, first of the fleet of three, as it received final touches before launching. The planes cost \$2,100,000, have been in construction about a year



*Wed. Glinted Aircraft Corp.
Stratford Conn. Oct.*
New speed records for scheduled air-crossings of the Atlantic ocean are promised by three great passenger planes built by Vought-Sikorsky Aircraft for American Export Airlines. Four Pratt and Whitney air-cooled engines, delivering a total of 4,800 horsepower, will pull the ships at a top speed of 235 miles per hour and a cruising speed of 175 miles per hour in long-distance hops. Capable of spanning the ocean in nonstop flights, the air liners will offer full-size sleeping accommodations for 16 passengers, or can be outfitted to carry 40 daytime riders. In each ship is a complete galley where full-course, hot meals can be prepared in the air. Tails of the ships, reaching higher than a three-story build-

ing, have a surface area greater than the entire surface area of the average military pursuit ship. The eighty-foot-long hulls are divided into 12 compartments, besides the flight bridge on the upper deck. The three-bladed propellers have a diameter of 12½ feet. The air-conditioning system is of new design, and each passenger will have an individual cold-air valve control.

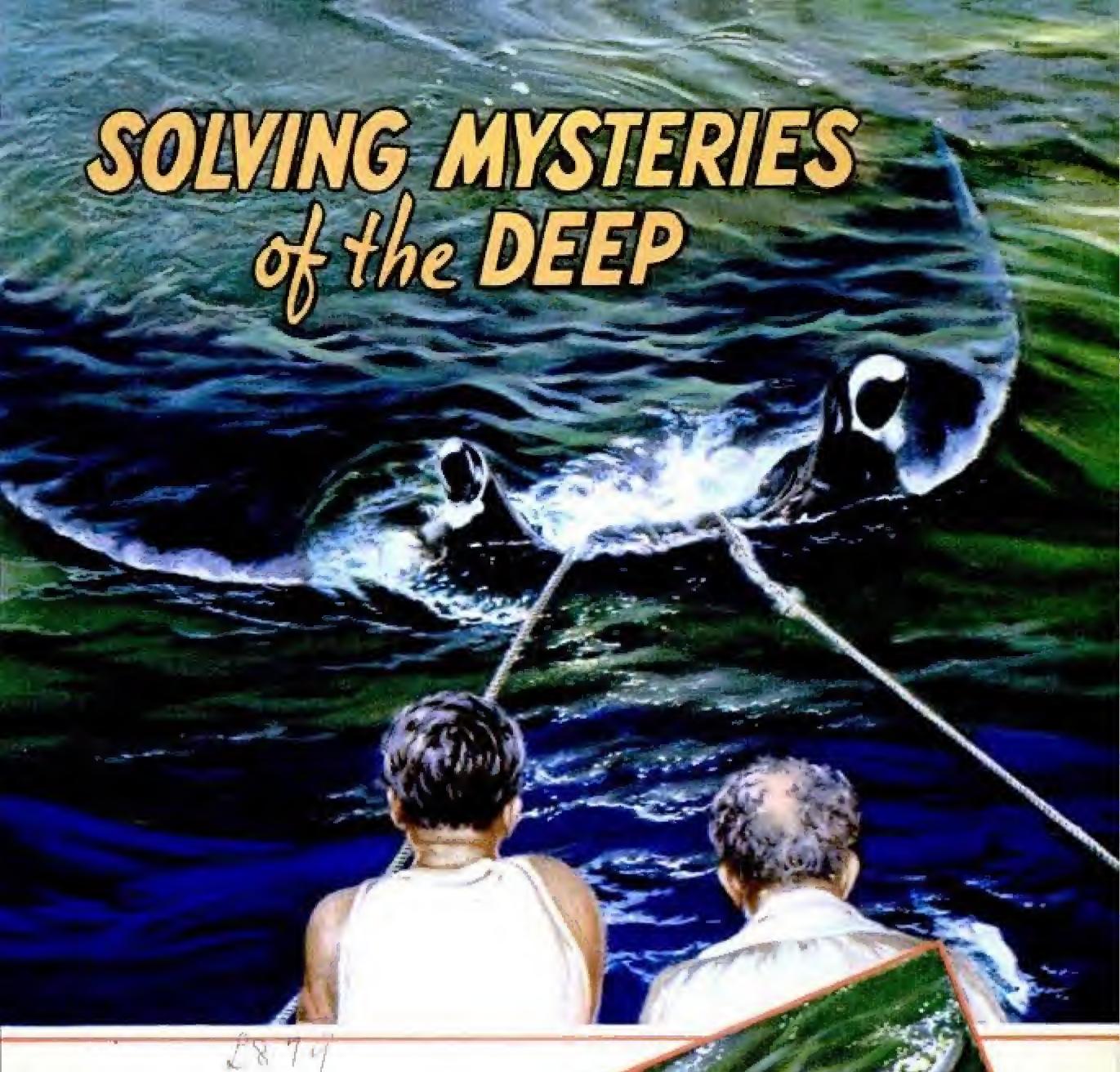
L1251

New Process Produces Aluminum From Plentiful Clay

This country may be made independent of foreign sources of aluminum ores as a result of a new process by which aluminum is manufactured from clay instead of the mineral bauxite, of which it is estimated that we have only about three years' supply at the present rate of consumption. Developed under the direction of Prof. Arthur W. Hixon of Columbia University,

the process is said to involve a technique never before employed in metallurgy. Selected high-silica clays are digested with hydrochloric acid and the resulting product is decomposed to get aluminum oxide. From that point the usual method of extracting the metallic aluminum by electrolysis is used. The chemicals used are by-products of other industrial processes.

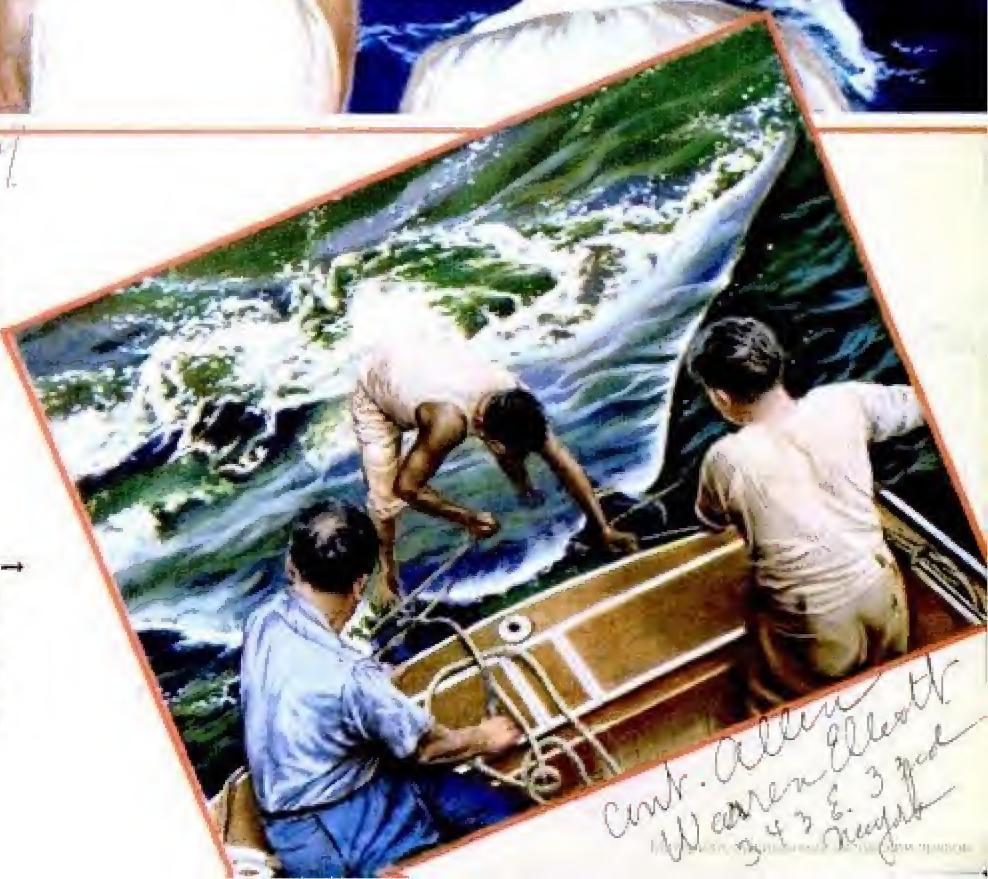
SOLVING MYSTERIES of the DEEP



£8.79

Two weird eyes protruding from the ocean surface are those of a giant manta measuring 20 feet from tip to tip of its wings, weighing three tons. It was harpooned off Cape Blanco, Peru

Bringing in one of these → enormous, batlike mantas is no child's play. Here a Peruvian fisherman, riding the harpooned manta like a surfboard, helps the expedition crew make it fast to the boat





From his lofty perch, the lookout of the expedition's outrigger launch "Alone" has just sighted a killer whale in the Pacific, off the shore of Ecuador

8/2/79



THERE are billions of tons of succulent food down in the depths of the ocean, but until now man has done very little about harvesting it.

Americans consume chiefly salmon, tuna and sardines because they can be caught in great quantities at certain places and seasons, so that it pays to erect canning factories. We catch the easy ones, and let it go at that. We know so little of the life habits of the bigger game fish of the deep sea that we have never been able to put them on a "quantity production" basis.

Now, at last, thanks to a fresh line of research started by a New York and Miami sportsman with a scientific turn of mind, and by the learned ichthyologists of the American Museum of Natural History, the world is starting to ride herd systematically on the huge game fish which feed in the cool green depths and offer unsurpassed food value. These men are beginning to solve one of the great secrets of the sea—the mystery of mass migration.

← This giant squid's appetite proved fatal. Grabbing a smaller squid already hooked, he held on until boated. The tentacles are those of the big fellow, ready to swallow his prey

With all of our modern biological information, no man today can tell where the American broadbill swordfish spawns, or where it spends its earliest days, although it is one of the first fish mentioned in all human history. Two reasons exist for this public attention. One is its delicious flavor, recorded by the ancient Greeks. The other is for its nerve-wracking habit of plunging into fishing boats at express-train speed, ramming the sword through both sides of a skiff, or burying it in the timber of a larger vessel. The great natural historian Pliny who died in 79 A.D., and who wrote the first book ever printed on fishes, though it wasn't published until 1,400 years later, told of a swordfish sinking a ship.

A more modern instance was attested to in 1826 when the whaler "Fortune" returned to Plymouth, Mass., with a broken-off sword embedded in the hull. It was found to have penetrated the copper sheathing, a one-inch board, a three-inch hardwood plank, a solid oak timber twelve inches thick, a hard oak ceiling plank two and one-half inches thick and finally the head of an oil cask.

Still, comparatively little of practical importance is known of its personality and habits, except that it grows from pinpoint size to six or eight hundred pounds and some ten feet in length in a year or so, has formidable teeth when it is very young and loses the teeth before it is four feet long, developing the rather flat sword, also about four feet long. This sword it uses to impale larger fishes or to slash into a school of smaller ones, stunning or killing them.

One scientific theory is that the swordfish is born at very great depth, shortly after



Michael Lerner, expedition leader, and the captain haul in a striped marlin caught on rod and reel off New Zealand coast



↑ A striped marlin puts up a terrific battle against the hook

↓ Making a cast of a blue marlin taken in New Zealand waters





The fight over, a blue marlin weighing 708 pounds is hauled up at the stern and measured

the secrets of such hard-hitting fellows as the swordfish, sailfish, and marlin is Michael Lerner, who turned from fishing for sport to fishing for science. Trustee of the American Museum of Natural History and Associate for its Department of Ichthyology, he is also one of the moving spirits back of the recently founded International Game Fish Association, which is studying the habits of game fish, deciding upon all

world record rod and reel catches, and generally acting as the clearing house for angling problems and information. Already reports are flowing into the New York headquarters at the Museum from outposts ranging from Africa to Australia.

As each piece of data comes in, a dot is placed on a map devoted to the species, an arrow indicates the currents, water tem-

which he fastens his teeth in a larger fish and permits his host, or other hosts, to carry him around until his sword is grown and he can shift for himself.

But now modern science is attempting to trace every step of his life, every move in his migratory cycle as well as those of other desirable game fish whose incalculable aggregate bulk would add considerably to the world's food supply.

The man behind the move to catalogue

Two expedition members help bring in a big sea turtle



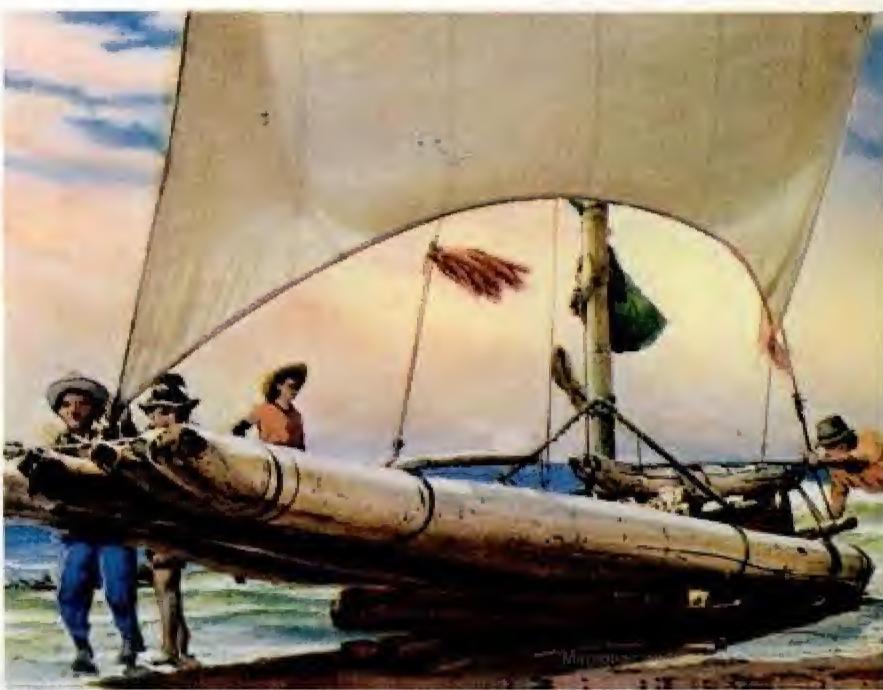


peratures, and so on. Charts take form and soon the information is put into general shape. Dealing with Atlantic sailfish, this might read: "Distribution: Brazil, north to Woods Hole, Mass.; and Devon, England. Greatest Concentration: Bahamas, Dec. and Jan.; Florida, all year, particularly Jan. to Mar.; Port Isabel, Texas, May to Nov., particularly July and Aug."

An example of the unpredictable behavior of the swordfish which the organization is trying to solve is cited by Dr. Roy Chapman Andrews, former Director of the American Museum of Natural History.

L 879
Michael Lerner and his wife admire a day's catch off New Zealand. Left to right, a mako shark, two striped marlin, a thresher shark

Raft of balsa logs, so light four men could carry it, was used by Peruvian fishermen assisting expedition in catching local reef fish



879

One glance at the mouth of this mako shark demonstrates why it is one of the most dangerous creatures in the ocean



He says: "A very important question to which commercial fishermen would like to know the answer, is why the range of swordfish off the coast should vary each year in spite of the general distribution of their food. For instance, the fishing communities of Cape Breton, and other parts of Nova Scotia were lucky when the swordfish were running only 30 miles from their harbors in 1936. Their small boats could set out in the morning, catch a large fish or two and return to port by night, well repaid for a day's labor. But the following summer, in 1937, the swordfish ran 200 miles off the coast for some unknown reason. Fishermen who depended on this source for the markets and their winter food supply were destitute. Their small boats were not equal in speed or equipment to this great distance.

"If the Lerner survey can find out what conditions govern the swordfish migrations, it will be possible to predict the supply."

One reason science knows so little about the movements of the ocean game fish is that full-grown examples are too large to be transplanted into laboratories where patient research and mathematical deduction would reveal many of their obscure aspects. Commercial fishermen regularly land many swordfish weighing more than 400 pounds.

Even if these could be transported quickly to the dissection tables of a museum, by the time they have been harpooned, tussled with and hauled up from the ocean's depths, they are not fit laboratory specimens.

So Michael Lerner set out to

After numerous giant squid had bitten off large hooks, Lerner brought them in by making tassels of smaller hooks which enmeshed in the tentacles

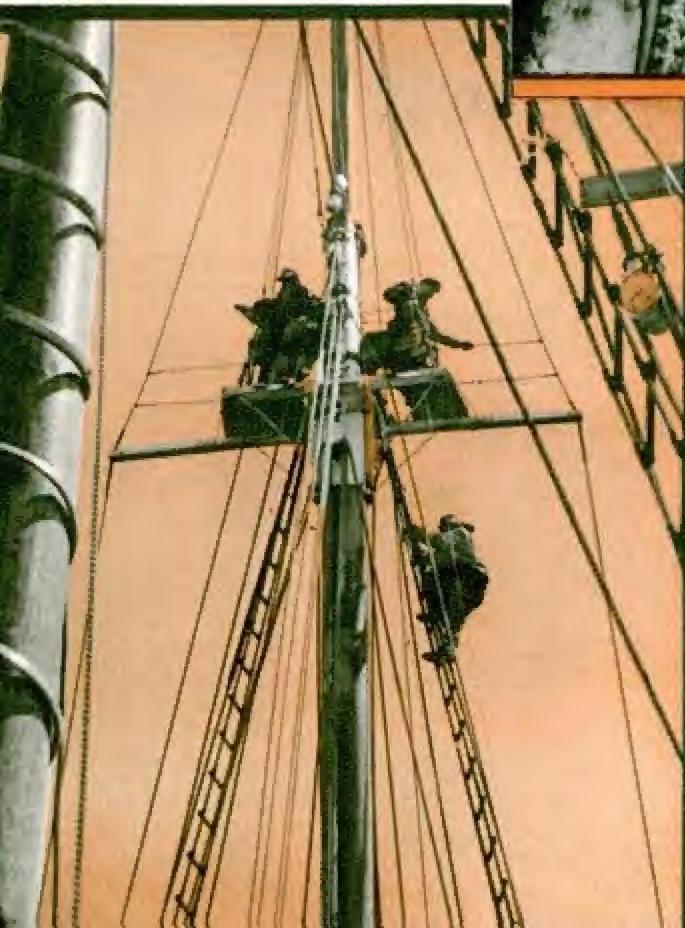
L 879

do two things, first to catch his big game fish with rod and line to avoid mutilation, and, second, to take science to the fish. Thus, on expeditions going out under the auspices of the American Museum of Natural History, which have found him trolling off Australia, New Zealand, Nova Scotia, Chile, Peru and the Island of Bimini, he has been accompanied by other expert game fish anglers, ichthyologists, and photographers. Also by Mrs. Lerner, who holds the women's world record for white shark and was the first woman to land a broadbill swordfish on rod and reel in Canadian waters. She also holds the women's record for striped marlin, with a 403-pounder, caught off Tocopilla, Chile. Less than 300 of the species have even been caught by rod and reel. Of these, Michael Lerner has landed 17.

Lookouts on an expedition schooner watch for swordfish off Nova Scotia



Hooded for protection from the squid's "ink," a fisherman brings a gaffed squid to boat off Peru. The oval orifice is the squid's powerful beak



On the expeditions, the results of which are now being compiled, the Lerners were accompanied by American Museum staff members; Florida fishing captains; and moving picture and still cameramen.

For months before an expedition sets out, the members are busy preparing. Finally, the last specimen tank is hoisted on board, the staff checks the equipment to make sure everything is on board, and the expedition is off. When the Chile-Peru expedition landed at their first base camp, 109 cases and boxes of equipment—tackle trunks, camera cases, tripods, formalin tanks, instrument cases, and special supplies—were lowered into the waiting tender.

This expedition was particularly seeking broadbill swordfish and the several



1879

Block and tackle were necessary to haul in a 667-pound broadbill swordfish off Tocopilla, Chile.

varieties of marlin, which are distant cousins in the mackerel family. Persistent reports had it that giants of the swordfish tribe had been seen off the coast of Peru. But when they arrived at Talara, Peru, disappointing news awaited them. Local fishermen told them that they had come at the wrong time of the year to catch the battling monsters.

"We felt pretty low," says Lerner. "Even if they were plentiful, experience had taught us that on the average only about one out of four swordfish will strike at the bait with his sword, which is the creature's way of 'killing' its food. Then, about one out of four of this number will swallow the hook, and even with the hook embedded, about one out of four will be landed."

But, as Lerner points out, a fishing enthusiast first of all is an optimist, so the party went to work patrolling the sea from

40 to 80 miles out in two 30-foot outriggered launches with lookouts stationed as high as possible to watch for the two-in-line fins which spell broadbill. This daily routine continued fruitlessly day after day.

There were plenty of fish and huge ones too—sharks, huge batlike manta rays, killer whales, and marlin. For the first time it has ever been accomplished, they even caught the dreaded Pacific squid, relative of the octopus, on rod and line. These too were valuable museum specimens, the first of the kind to be brought into its collections. But no gargantuan swordfish.

Then patience was rewarded. A swordfish was discovered circling around the surface, sunning his lean, lithe body.

Lerner seated himself on his chair, a platform mounted on a revolving stem with an adjustable footrest; dropped the butt

(Continued to page 176)

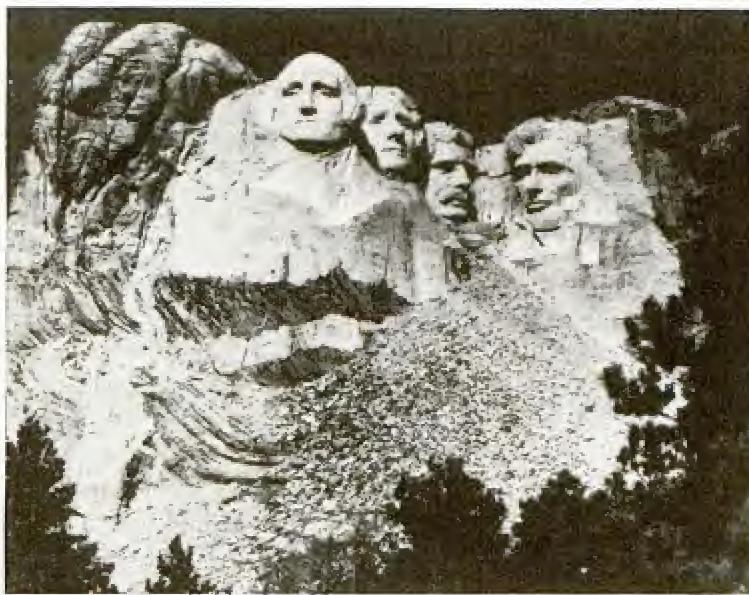
11226 Press Assn. One - 50 Rockefeller Plaza, New York

Mt. Rushmore Memorial Ready After 15 Years

After nearly 15 years under the skilled hands of sculptors, the great Mount Rushmore National Memorial has now been finished. Machinery and scaffolding are being dismantled, so visitors for the first time may have an uncluttered view of the gigantic figures of Washington, Jefferson, Theodore Roosevelt and Lincoln. The busts, proportionate to men 465 feet tall, are carved in a 700-foot monolith of granite in the Black Hills of South Dakota. From the top of Washington's head to the tip of his chin is 60 feet. Work on the monument was started in 1927 under the direction of Gutzon Borglum, who died last year. It was carried to completion by his son, Lincoln Borglum.



Close-up view of Theodore Roosevelt's face as sculptors give it final touches. Man pointing is Lincoln Borglum



Here is how Mount Rushmore National Monument appears from highway nearby. Faces are hewn in granite cliff

*Canyon Caffeine My
grape juice*

Air-Conditioned Operating Room Keeps Drafts Off Patient

Draftless air conditioning, safe for use in hospital operating rooms and bringing relief from summer heat to surgeons, attendants and nurses, has been achieved with a unit installed in St. Francis' Hospital, Poughkeepsie, N. Y. Only outside air is taken in, its temperature and humidity regulated as desired, and the conditioned air distributed gently about the room. Four outlet ducts, located in the corners of the room, are so arranged that the clean air

passes down the walls and across the floor to the middle of the room where it rises about the operating table without allowing drafts that might endanger the patient. For protection against explosion, humidity is not permitted to drop below 55 percent.

The 200-inch Mt. Palomar telescope weighs 520 tons and is over eight stories high, yet it is balanced so delicately that it can be moved with a finger.

L 114.2

Chemical Frees Roof Drain Of Ice and Snow



Installed in drain, this device melts ice and snow

Roof drains and leaders can be kept clear of ice and snow by a chemical device that adjusts to fit all shapes of drains from two to six inches in size. The chemical which melts ice is dispensed only when in contact with the snow or ice, and one filling suffices for a season. Harmless to roofing materials, it is installed without tools.

Short, Lightweight Infantry Rifle Adopted by U. S. Army

To be carried by infantry troops, the Winchester carbine adopted by the United States Army can be used both defensively



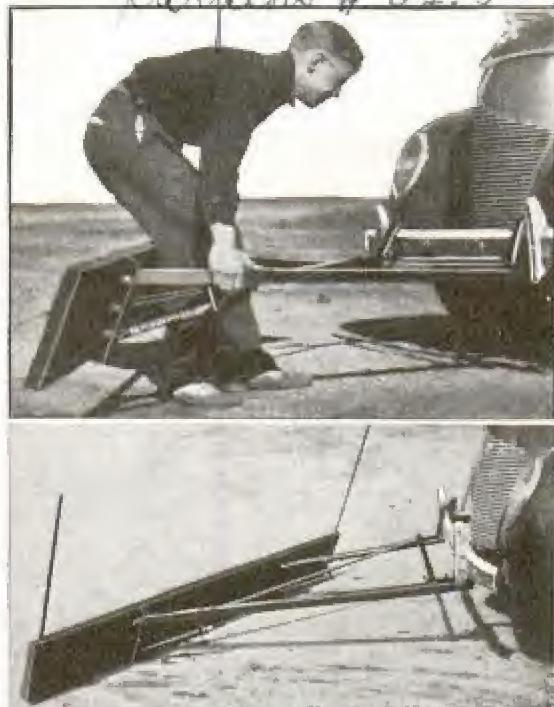
New infantry weapon shorter and lighter than Garand

and offensively. It will largely replace the .45 caliber pistol, which is essentially a defensive weapon. The new rifle weighs almost 4½ pounds less than the Garand, basic rifle of the Army, and is 7½ inches shorter. After exhaustive tests of five different lightweight rifles, the Winchester carbine was found best suited to the rugged handling it will have in military service.

L 1286

Snowplow Hooked to Car Bumper Clears Driveway With Ease

You can use your own car or truck for removing snow from driveways, parking lots, walks or other areas, by fitting it with a snowplow easy to attach and remove. Slipping two hooks over the bumper bar completes the connection to the car. The



Top, attaching plow to car; bottom, ready for action

steel hooks are lined with webbing to protect the bumper finish, while shock absorbers take the strain from the bumper when passing over bumps. Runners at the bottom of the blade maintain the correct angle for pushing snow and raise the plow above sidewalks when crossing cleared areas.

Thirty-four new streamline trains have been added to the American railway fleets during the last year, bringing the total to 121 trains; 26 more are being built.

✓ L1209

Air Corps Headquarters
Randolph Field, Tex.

Planes Parked on Noses Await Call to Service



Removing primary training planes from storage at Randolph Field, whence they flew to aviation schools

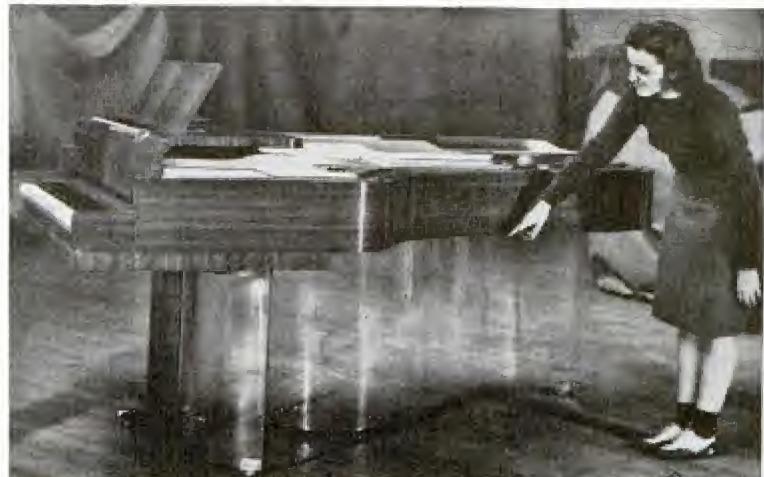
When the six new primary flying schools of the Gulf Coast Air Training Center opened to train pilots for national defense, primary training planes aplenty were ready for instructors and students. The planes,

built while the fields were under construction, had been ferried to Randolph Field, Tex., and parked on their noses to save hangar space. It was a simple task to haul them out and fly them to the new fields.

L1210 Grand Piano "Floating on Air" Has a Transparent Base

Supported on a base of transparent plastic curved to conform with the lines of the instrument, a grand piano appears to hang in the air when viewed from several feet distant. Despite its "invisibility," the plastic base is strong enough to carry the heavy burden.

Almost invisible, the base of this grand piano seems to hang like a transparent curtain. It is a sheet of strong plastic



8/1/36

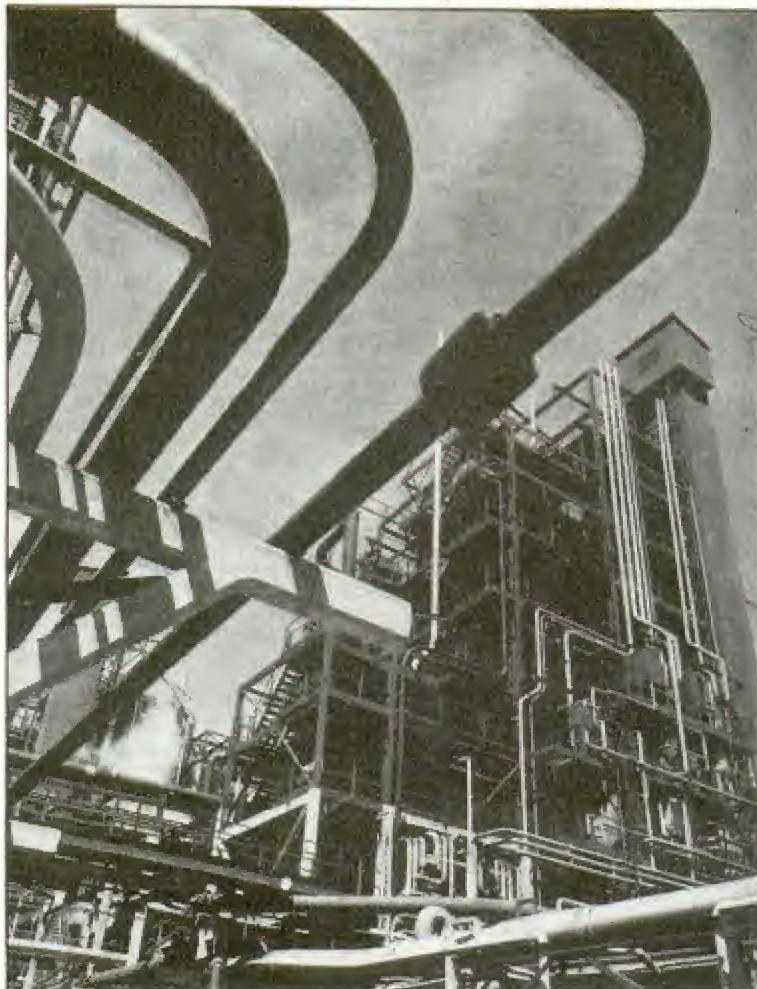
SUBWAY for BLACK GOLD

By

Roderick M. Grant

ONE HUNDRED oil tankers are blasted to the bottom of the sea. Fifty more are loaned to Britain. Down-east motorists jam filling stations to beat the twilight curfew and growl at a threat of rationing in a land that has been a land of plenty producing 65 percent of the world's petroleum.

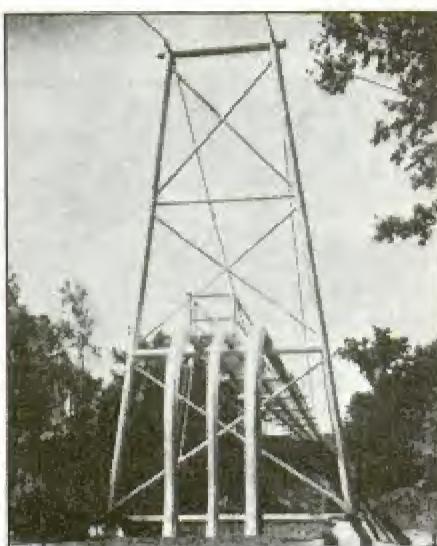
And as the ships go down, America becomes suddenly and pleasantly aware of its vast "underground railway" of pipelines. It is growing like an adolescent. Crude oil has just begun to flow through a new 236-mile line from Portland, Me., to Montreal, saving a 10-day, 2,000-mile trip by tankship up the St. Lawrence. Pure Oil and Gulf have completed a 450-mile tube to carry 30,000 barrels of gasoline per



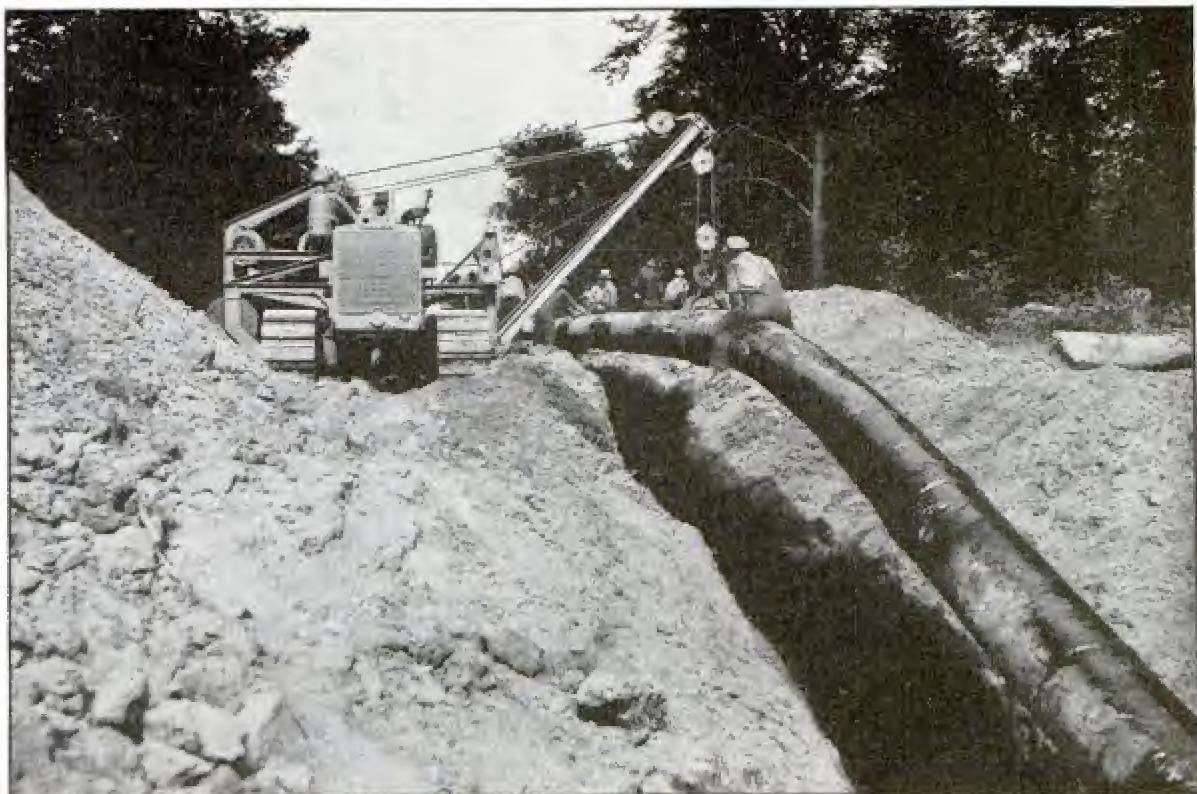
Here is a pipe line's terminus, the Standard Oil refinery, Whiting, Indiana

An oil line makes a high jump on a trestle

A Caterpillar tractor gently drops the huge pipe into trench



L 1186



Caterpillar Tractor Co. photo

Pleasant Hill.

Sections of pipe 118 feet long, bent to fit contours of hill country, are eased into position by boom

day from Florida coast docks to Chattanooga. From Baton Rouge to Greensboro, N. C., a 1,260-mile gasoline line is being laid. When it starts its river eastward it should release ten coastwise tankers. Socony-Vacuum has just built new gasoline arteries from Syracuse to Elmira and Binghamton, N. Y., and from Topeka, Kan., to Sioux Falls, S. D. And vaster than any oil line ever built is the projected National Defense Pipe Line, already surveyed by aerial map-pers but halted momentarily at least by refusal of steel from priorities authorities. If built, this gigantic 24-inch pipe would deliver 250,000 barrels a day from Texas to Philadelphia and New York, more than 1,500 miles away.

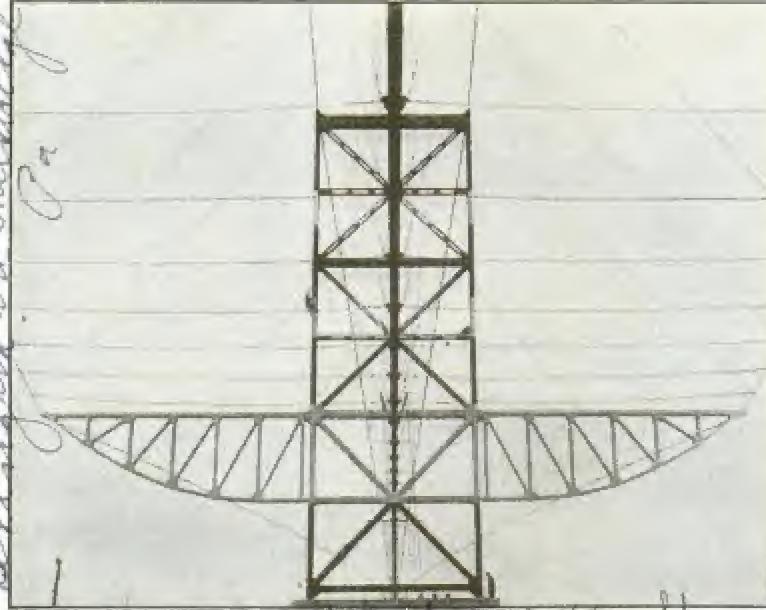
Together, arteries of black gold stretch more than 126,400 miles across the states, more than a mile of pipe for every four miles of paved highway

or of railway in the United States. They form in themselves a tremendous reservoir through which at this moment 21,000,000 barrels of crude oil and gasoline and petroleum derivatives are creeping at three to four miles an hour from well to refinery and refinery to your tractor or furnace or automobile or parlor lamp. Pipe lines bridge the Louisiana swamps on stilts, lie

Examining a three-dimension aerial survey map of an oil-line route
Aero Exploration Co., Tulsa, Okla.



21186



A 16-inch pipe line crosses Missouri river on half-mile suspension bridge

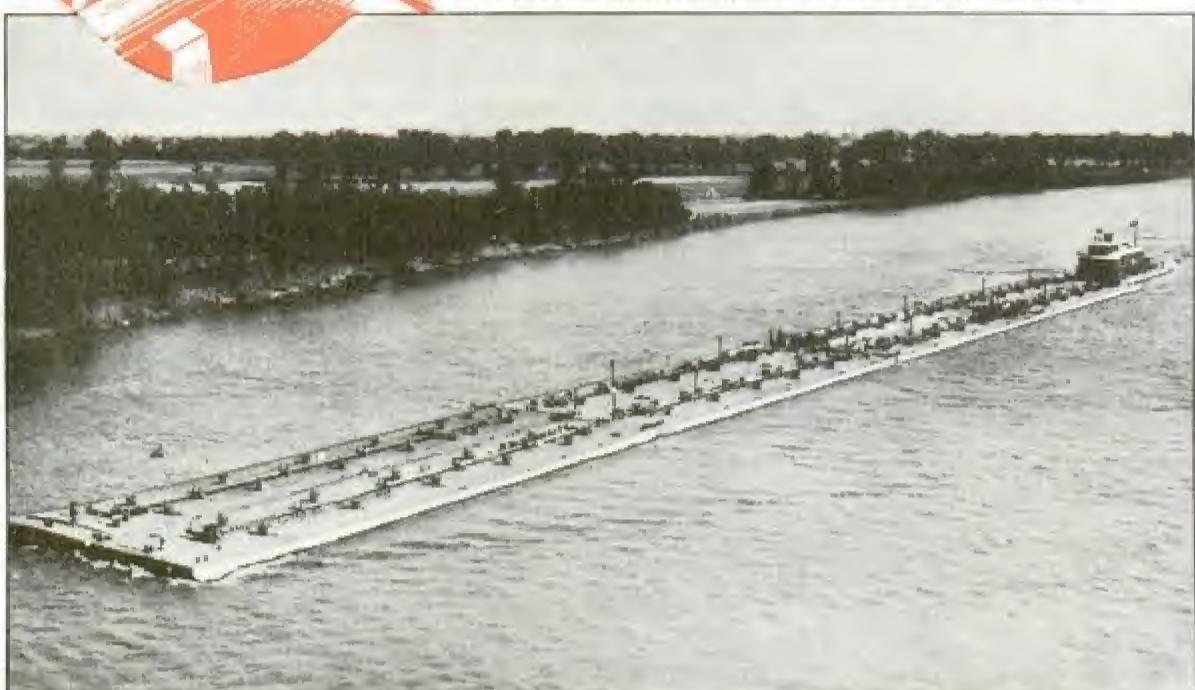
Robert + water st

S. V. Paul, Minn.

pipe. However, by 1863 pipe lines two or three miles long were being built, and they worked. Today they are growing by 10,000 miles a year.

This business of building and operating a pipe line has been revolutionized in the last ten years. Today, paradoxically, the "groundwork" for a new line is done in the air. Before snowfall the Aero Exploration company of Tulsa finished mapping the route of the National Defense Pipe Line. Two

"Switchman," left, reroutes oil at pumping station by turning Nordstrom valve. Below, the pipe line's rival: Socony-Vacuum tug pushes 3,500,000 gallons of gasoline up the Mississippi



2186



First pipe line to cross continental divide, from Wyoming to Salt Lake City, is lowered to river bed

planes, carrying pilot and cameraman, flew 15,300 feet above ground level over the course from Longview, Tex., and Wood River, Ill., to Salem, Ill., and on to Bayonne, N. J., flying at 140 miles an hour. Every 20 to 30 seconds, according to ground speed,

the cameraman turned a crank to expose the film; in a strip map the pictures must overlap and an exposure a second too late might miss the overlap. At the end of 100 exposures the film must be changed, the

(Continued to page 194)

Dot-dash lines on map indicate oil lines being built or just completed; single dotted line marks route planned for the now deferred National Defense Pipe Line. Others are principal existing lines



L1250

Chair Built to Be Straddled Has Tea Tray on Back



Chair as it should be straddled; inset, front view

Refreshments may be enjoyed in comfort if you have an upholstered "straddle chair" that answers a long-felt need for a different kind of sitting relaxation. Across the top of the back is a broad, level surface on which a cup and saucer will rest safely as you sit at ease straddling the back support. Of course, the chair may be used in the ordinary manner, also.

L1247

Sand Blaster for Small Articles Is Cheap to Operate

Sand blasting small glass or metal articles, such as signs, name plates, house



Designs sand blasted on glass in simple operation

numbers and ground glass for cameras, can be accomplished in a simple operation with a compact, portable machine now available for small shops and home craftsmen. Cheap glassware and pottery can be given a more expensive finish. Run by a quarter-horsepower motor, the eight-pound machine operates by centrifugal force instead of compressed air, and handles any piece of work that can be placed on top of it and moved about as cutting progresses. For cutting designs on wood, tape may be applied and the parts to be sanded cut out with a knife and peeled off.

L1284

Adjustable Winter Front for Auto Fits Many Models

Made in two sections fastened together by a series of button-clasps, a self-adjusting winter front fits most automobile models of the last three or four years. The two



Two-piece winter front adjusts to fit car radiator

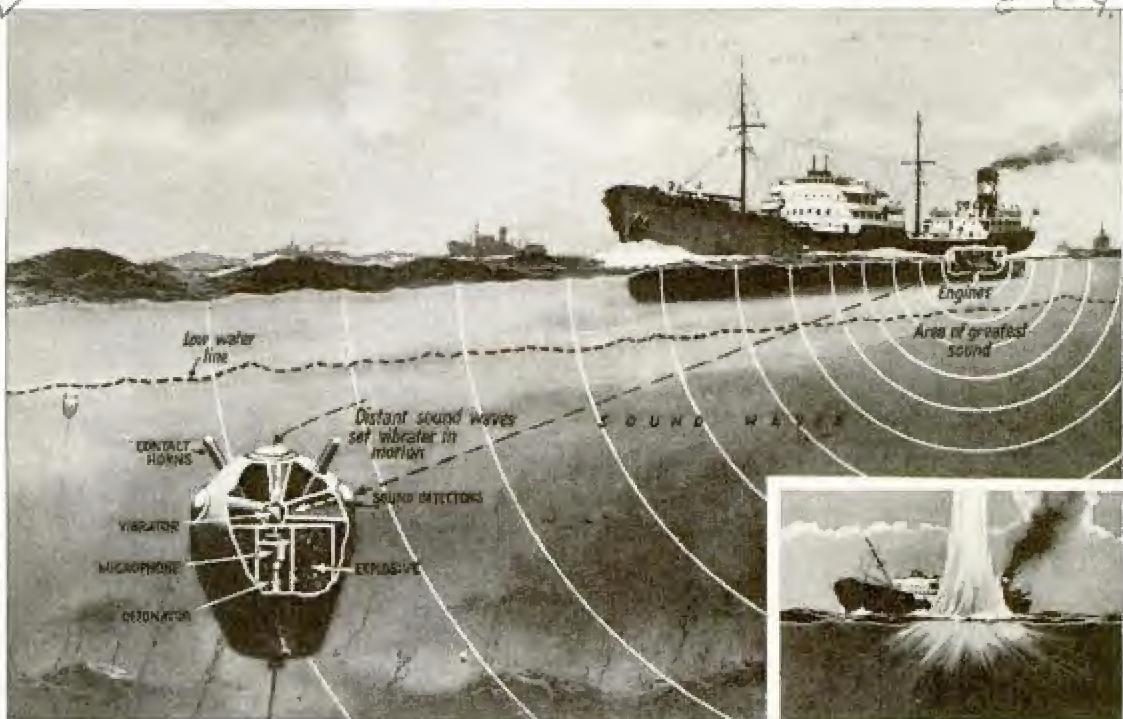
parts are placed against the radiator behind the grille and joined at a point which permits them to cover the largest possible area. Two straps at the upper corners are passed around the radiator and hooked together to hold it in place. A coil spring at the end of one strap allows for various radiator thicknesses.

L1250 *dynamatinal steel*

(A new revolving door controlled by an electric eye turns automatically and lets you walk through without pushing it.

L1215 London Electricity Agency, Ltd
184 Fleet St., London

Mine Explodes by Sound From Ship's Engines



Acoustic mine does not wait for contact but explodes when ship draws near, as shown in the inset

L1215
Acoustic mines are now being used by Germany in attempts to block English coastal waters, Prime Minister Churchill disclosed recently. Laid by night in the approaches to harbors, the latest mines are equipped with sound-detectors that pick

up sound waves from a ship's engines. The vibrations act on a vibrating reed, producing electrical impulses, and when these become powerful enough, due to the nearness of the ship, they set off the explosive charge contained by the mine.

L1214 Portable Runway for Airport Follows Advancing Army

As today's United States Army rolls forward, it will carry along a portable airfield packed in trucks or railroad cars, which will permit the establishment of an air base

for protection of its advanced position and for harassing enemy troop concentrations. The portable field consists of steel planks, weighing 50 pounds each, which are laid on

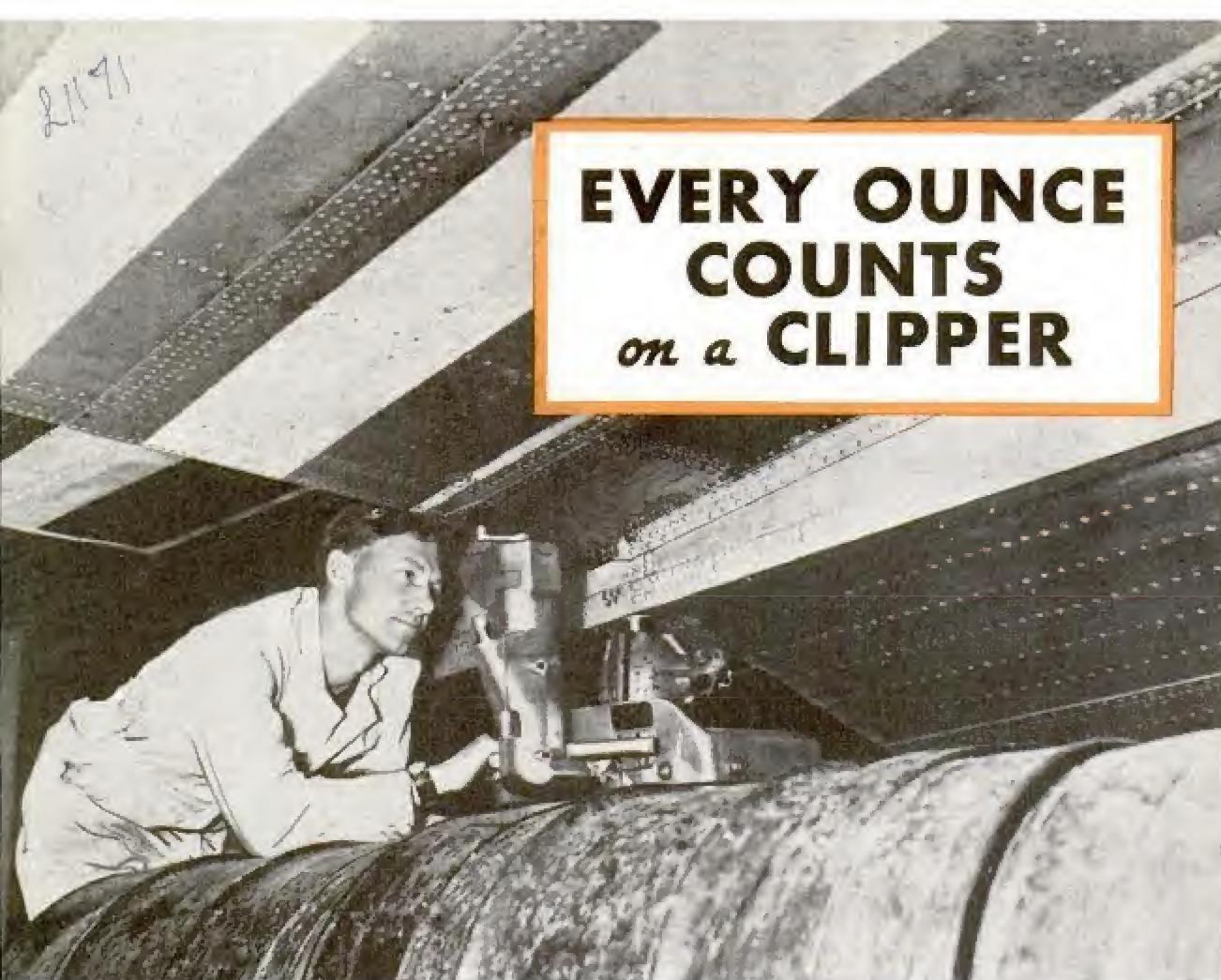
level ground to form runways and held together with clips to prevent sliding. In this way a landing area 3,000 feet long and 350 feet wide can be laid out, although only 150 feet of the width is of the steel planks and the remainder hard and level sand. If the terrain is rough, "bulldozers" and carryalls make it level.



Enough of these steel planks can be carried by an army to lay a landing strip 350 feet wide and 3,000 feet long

21191

EVERY OUNCE COUNTS on a CLIPPER



One of four scales on which great Pan American flying boat is placed for weighing at specified intervals

One of mighty engines which propels the Clipper is shown being serviced; replacement of parts usually adds to weight



THE 41½-ton flying boat was nearly ready to depart on the first leg of its 9,000-mile flight across the Pacific. The weigh master checked his figures, then held up an arm.

"Hold it," he called. "You are two and a half pounds overweight."

A steward carried a bucketful of ice from the galley and dumped it overboard. Not until then did the trans-oceanic air liner have permission to depart.

Ridiculous? Not at all. Pan American handles every routine departure just as carefully as if it were the first test flight of an experimental plane. Every piece of equipment, every passenger and letter, even the butter in the galley, had been weighed. The weigh master

21191 Col. Thomas E. Strinson, Jr.
3892 Franklin Ave., Bos

radio

knew the total down to the last ounce.

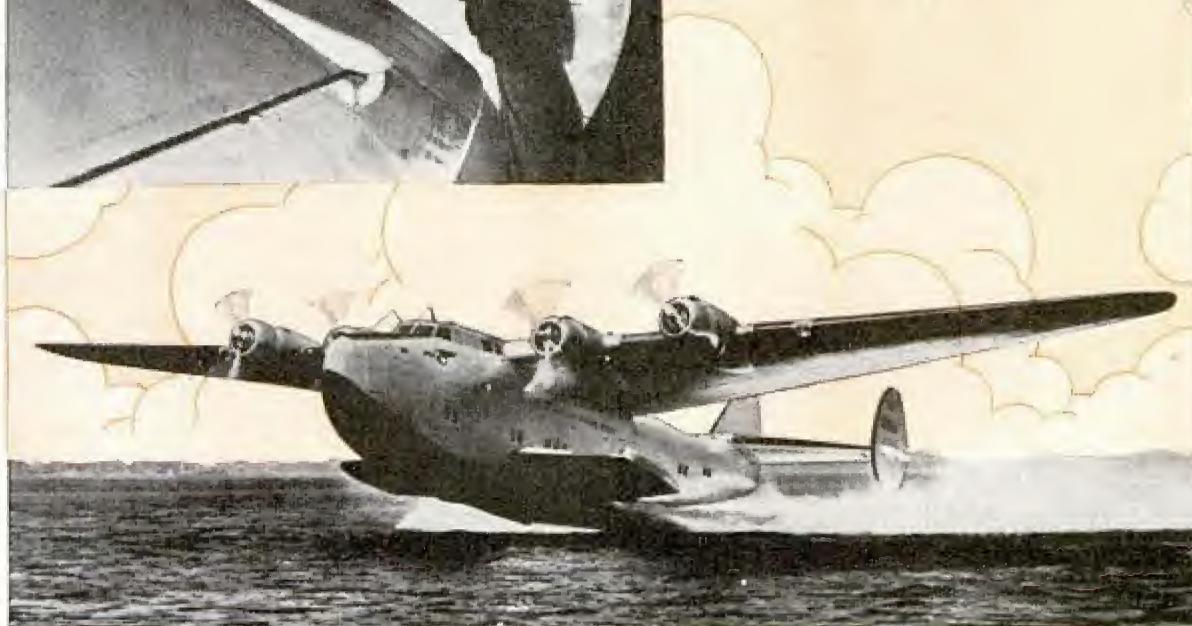
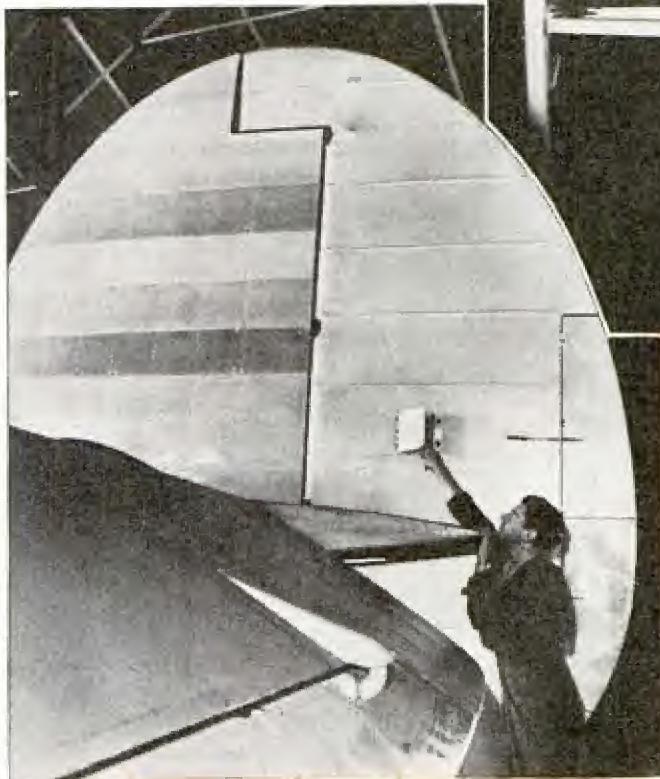
It would have been perfectly safe to have taken off with the extra two and a half pounds or with a hundred times this overload, but such extra weight would have eaten into the plane's reserve cruising radius. As it was, the plane was some 300 pounds overweight when the crew first went on board. Fifty extra gallons had been added to her fuel supply for warm-up and take-off. The weigh master knew that the 300 pounds



Navigator of a Clipper is shown taking star sight through transparent "astro dome"

← Checking the control lines on one of the flying boat's triple tail surfaces

Clipper with full load of passengers, mail and express getting off the water



George Verdares, Vice President
Pan American Airways Co. I never slept
down since I got married



Chief engineer, at control panels, is
in charge of engine operations

One of the powerful searchlights, en-
closed in wing, used as wing light



ority. The passenger list may fluctuate from seven or eight to 28, depending on the fuel and mail loads. These days there is always a waiting list.

Pan American's Clippers normally land at their destinations with enough fuel left in their tanks to take a fleet of automobiles across the United States and back. This reserve is for emergencies only and nothing short of an unexpected headwind is allowed to reduce it. That is why the air line insists that passengers be prompt. A 10 minute delay at the dock waiting for a tardy passenger really means a delay of more than half an hour because the additional fuel used in idling the engines or restarting them must be replaced before the plane departs. In flight, the boat begins to lose weight the instant it leaves the water. On the crossing from the mainland to Honolulu, for instance, the plane loses nine tons of its original fuel load.

Inevitably, a plane grows heavier with age. Trying to keep the weight down is a losing battle although the maintenance crews fight it ounce

Navigator of Clipper at his chart
table in plane's control cabin



of fuel would be consumed by the time the flying boat got off the water and that by then her weight would match his figures.

Weight control and the weather decide how many passengers and what weight of mail and cargo can be taken. The captain rarely flies the shortest distance between points. He takes advantage of existing winds to fly the shortest time instead. Enough fuel for such a trip, with an almost 40 percent reserve, is the first item to go aboard. Next the mail has pri-

8/15/



Part of control cabin showing navigator and radio man at left and right

Any item removed from or added to Clipper is weighed and entry made in log



by ounce. Every pound of weight added to a big flying boat, it is estimated, reduces payload capacity by \$90 a year.

Some of this extra poundage can't be helped and some of it can be prevented. Residue oil clinging to the walls of the oil tanks and lines adds 100 pounds to the plane's original dry weight. This increase remains constant. Moisture absorbed by the plane's cushions and soundproofing adds another 100 pounds, so between flights the interior is dried out as much as possible by batteries of infrared lamps. Not even the dirt tracked into the plane by passengers and crew can be disregarded. Between flights the cleaners remove some 20 pounds of material, mostly in the form of floor dirt and grease from behind the exhaust stacks.

Repairs cause a plane to grow heavy because replacements are ordinarily of heavier material, larger than the original parts when lap joints must be made. A few rivets added here and there, some spot painting inside the plane, all add up. As new developments in radio and other safety devices are made, such new

(Continued to page 185)

21206

Suspension Test for Wheel Shows How It Balances



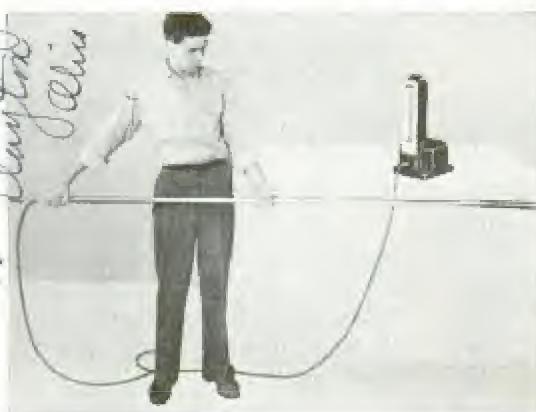
Checking auto-wheel balance with suspension tester

Testing the wheel and tire assembly for balance in one simple operation, a suspension device now on the market does not require spinning the wheel. With the wheel suspended by its center, the unit acts as a delicate beam balance, instantly showing any condition of unbalance and the direction thereof. It also tells when the right amount of weights have been added to restore the wheel balance.

21202

Flow of Air Measures Gun Bore Without Injuring the Rifling

To guard against damaging the inner surface of the gun barrel, which is likely to be injured by contact with metal, a new



Gauge uses air pressure to measure the bore of gun

gauge for measuring the bore uses air instead of a contacting finger. As the gauge is passed through the bore, any difference in the diameter from the norm will increase or decrease the velocity of air, and this is registered on an easily read indicator. The instrument shows the location and extent of out-of-round, taper or bell condition.

21191

Nonreflecting Surface for Glass Clarifies Television Image

Following up a clue given by Lord Rayleigh, English physicist, Dr. F. H. Nicoll of RCA research laboratories has developed a new method for ridding glass of reflections. The famed physicist had noted that one part of hydrofluoric acid, diluted in 200 parts of water, removed a thickness of glass corresponding to about one-quarter



Nonreflecting glass covers left half of this picture

wavelength of light each hour. Dr. Nicoll's formula involves exposing the glass surface to hydrofluoric acid vapor, which etches away a small amount of glass and leaves a thin, transparent film of calcium fluoride about one-quarter wavelength of light in thickness. The result is a surface that eliminates 10 percent of the visible reflection. It withstands hard rubbing; can be washed with water, alcohol and a number of other solutions, and can be exposed to reasonably high temperatures without los-

*Very Adhesive
481 E 2nd St.*

Los Angeles Calif
ing its nonreflective qualities. Applied to television, the treated glass surface will produce clearer pictures, since the images are first "painted" on the glass face of a cathode-ray tube, then passed through a thick glass protector plate to a glass mirror. It will also eliminate glare from show windows, framed pictures and ground-glass screens on cameras. Reflectionproof glass on instrument dials of airplanes and automobiles will minimize the chance of error in reading. The light-transmitting quality of lenses can be increased by reducing the amount of light lost by reflection.

L1154
**Dry Adhesive on Gummed Labels
Sticks Without Moistening**

✓ Gummed with a dry adhesive that needs no moistening to stick them on objects, labels now available may be applied, removed and applied again, leaving no marks. Neither moisture nor extreme dryness can cause them to peel off. The labels are delivered on rolled-up strips of thin material from which they can be removed easily, each roll being packed in a dispensing carton. Prices, identification marks, etc., can be written on the label with pen or typewriter before peeling the label from the backing material. It will adhere to almost any nonporous surface such as polished metals and wood, plastics, glass, enamel, paint or smooth leather. For sealing flaps of transparent wrappings, as Cellophane and Pliofilm, the dry labels are especially handy since they permit the flaps to be opened and resealed without destroying the label or wrapper.

Kleen Kleen

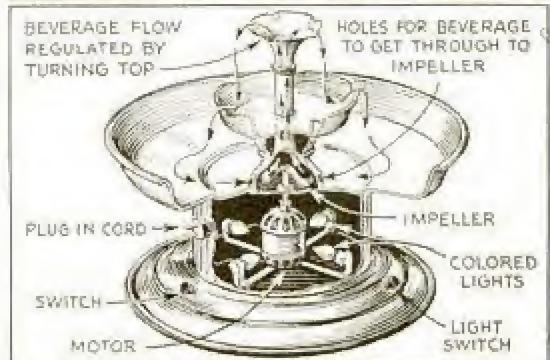


Labels, torn off as needed, stick to most objects

FEBRUARY, 1942

L1204

Electric Beverage Fountain ✓ Keeps Drinks Flowing



Guests may fill their glasses at electric fountain

Eight streams of beverage pour constantly from a decorative electric fountain designed for parties. After the liquid falls into a large bowl at the base, it passes through holes to an impeller that drives it again to the top of the funnel-shaped spout. Thence it flows down to a smaller pan dividing into the eight streams where guests may fill their glasses. Colored lights make the beverage glow invitingly.

L1208

Changeable Speed-Limit Signs Show Lower Speed at Night

On U. S. highways 40 and 50, east of Wendover, Utah, traffic signs provide for a speed limit of 60 miles an hour in daytime, but at night they change to read 50 miles an hour. The signs are of a new type which in natural daylight show a higher speed than they do against the rays of automobile headlights.

*Illinois Automobile Club
Chicago*

BATTLING WAR'S FIRE BUGS



Picked men of the Boston fire department, above, practice antiaircraft gunnery with a gun mounted on a fire engine. National guardsmen and coast artillery help train them. Below, London firemen demonstrate with 200 trailer pumps



AGENTS of the Federal Bureau of Investigation were hunting danger spots in a wharf area at Hoboken, N. J. The fire protection plans seemed complete. One company had installed 97 barrels of water, and above each a bucket labeled "Fire."

The G-men noticed that every barrel was brimful—but the surface looked suspiciously oily. Investigation developed that each barrel was topped with five gallons of fuel oil. A bucket of that "water" thrown on a small fire might have started a conflagration.

Sabotage? No. There had been trouble with mosquitoes, and an exterminating company had doused the barrels with oil to stop mosquito breeding.

Throughout the country the Bureau of Investigation has been surveying defense industries for fire hazards, incendiary or natural. Other agencies, too, are mustering forces against fire. All fire-fighting forces in Maryland are being coordinated for mutual as-

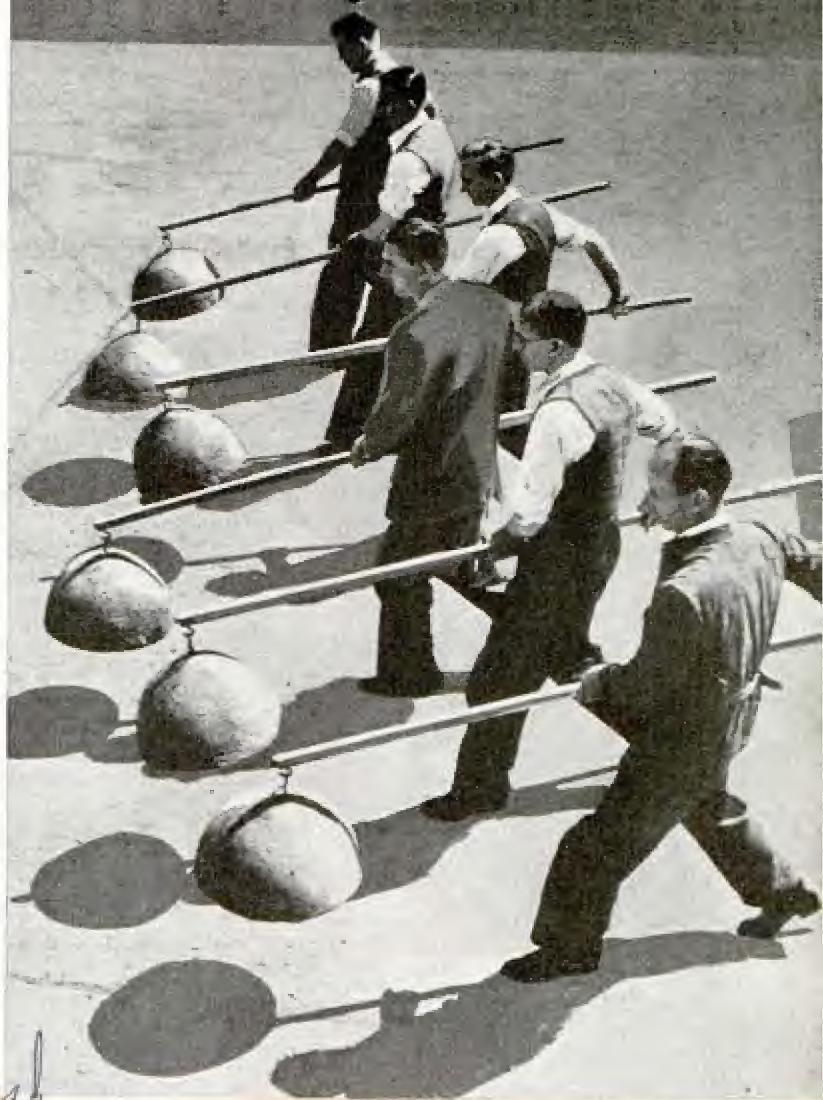
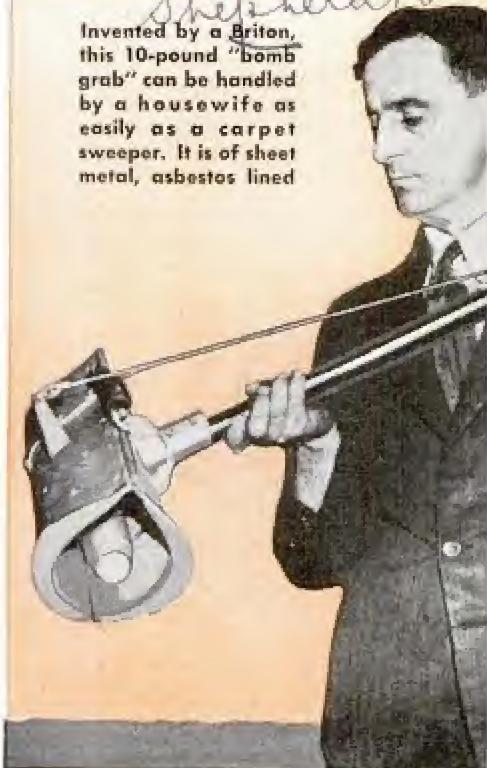
sistance among cities in emergencies. The Massachusetts State Fire Marshal—partly under the spur of the hurricane of 1938 which cost more than 500 lives and found few communities prepared for rescue work—has taken a statewide inventory of fire department equipment. When fire or flood or sabotage occurs, necessary equipment can be located instantly. In several regions, notably coastal cities, airplane watchers and fire spotters are being organized after the British rooftop watch system.

Readyng for war? Not necessarily. For defense, yes—defense against fire. For fire is the great destroyer in war, as in peace, and government and industry are taking all possible steps to prevent fire, incendiary or otherwise, in defense factories.

One of the toughest hazards the war has brought, both in Europe and America, is the magnesium fire. Abroad, it is

Is. Harry Boul

Invented by a Briton, this 10-pound "bomb grab" can be handled by a housewife as easily as a carpet sweeper. It is of sheet metal, asbestos lined



Thousands of these long-handled snuffers are spotted around English cities to fight incendiary bombs, which burn out under the asbestos dome. Below, control room of London's civil defense organization from which fire fighting and rescue work are directed



P. 817



The "Ghost Squad"—firemen of the Royal Air Force and air raid groups—wear asbestos suits

British firemen had to learn this treacherous characteristic of magnesium through disastrous experience. One fire started in a shed housing 15 tons of magnesium scrap. Firemen turned 20 hoses on the blaze. Feeding on oxygen in the water, the magnesium exploded violently, 14 men were injured, and the flames spread to sheds containing aluminum scrap and burned for 48 hours. Sparks from a tool set fire to magnesium turnings in a New Jersey plant. The fire was almost quenched by smothering it with talc when a sprinkler opened, the water washed off the talc and intensified the fire.

Incendiary bombs were used in the first world war, but they were not very effective. Thermit bombs, steel shells filled with a mixture of aluminum powder and iron oxide which burns violently when ignited, often burned out soon after the heat penetrated the steel skin. But the new "electron bomb" has proved horribly efficient.

It weighs only two pounds, and a bombing plane can carry 2,000. It can penetrate four inches of reinforced concrete; the chances are it will pierce the roof and lodge in the attic, often a difficult place to fight fire. Its thermit center is ignited by a percussion cap on impact, burning for perhaps a minute at 4,532 degrees Fahrenheit. Instead of

the most paralyzing of aerial weapons. Here, increasing use of magnesium alloys in aircraft construction has multiplied the chances of factory fires, and the peculiarities of this combustible metal have multiplied the problems of fire fighters. Trying to smother a magnesium blaze with water is like spraying a fire with gasoline.

"Bomb taxi" is used by Bridgeport, Conn., police for exploding bombs

*H. Lee O. Washburn
Ballistics expert*

Steel-helmeted women of the British fire watching corps show how to subdue a small fire, caused by incendiary bomb, with stirrup pumps



a steel shell its covering is magnesium, and jets of flame from the thermit core shoot from vents in the shell, scattering bits of molten magnesium for 50 feet. Then the magnesium shell burns brilliantly 10 or 15 minutes.

These are the flame pellets that have made blackened shells of British factories, homes, stores and historic shrines. They would do worse here, if the aerial "blitz" came to America; for wooden shingle roofs, which have disappeared in most of Europe, are a dangerous conflagration element in the United States. There is, of course, a percentage factor in favor of the defense. A bomber may carry 1,000 to 2,000 electron bombs; but it is estimated that only 15 percent of the ground space of an urban area is covered by buildings, so that about 150 of 1,000 bombs dropped would hit buildings. Of these, probably half would glance off or fail to penetrate the roof, and perhaps only 75 fires would result. A plane flying 200 miles an hour at 5,000 feet would drop 1,000 bombs, 20 per second, within three miles, setting fires every 60 yards. Multiply that by 100 or more planes and you conceive the burden falling on fire watchers.

Buildings can be protected by reinforcing roof timbers and flooring to prevent the bomb from penetrating, covering the flooring with some fire-resistant material—two inches of dry sand, brick dust, asbestos board or

(Continued to page 167)



↑ These are the small bombs that scatter flames over Europe. Loading the racks of a bomber at a British field

Darey

← Auxiliary fire fighters of Manchester, England, wear glass-windowed "smoke helmets" during air raids

↓ While other employes go to shelters, women in asbestos uniforms tackle a factory fire with snuffers and pumps



L1126 General Electric
570 Lexington

✓ Fixtures Direct Heat Rays From Self-Reflecting Lamp



These two fixtures aim self-reflecting heat lamps

Two special electric fixtures in modern style are now available for convenience in using the new self-reflecting heat lamps, which need no separate aluminum reflectors. One fixture is a floor model, the other for table use, the latter having a hole at the base so it may be hung on the wall if desired. Both provide for adjustment to a wide variety of positions for directing the angle of radiation.

✓ Lack of Vitamin A for One Day Increases Night Blindness

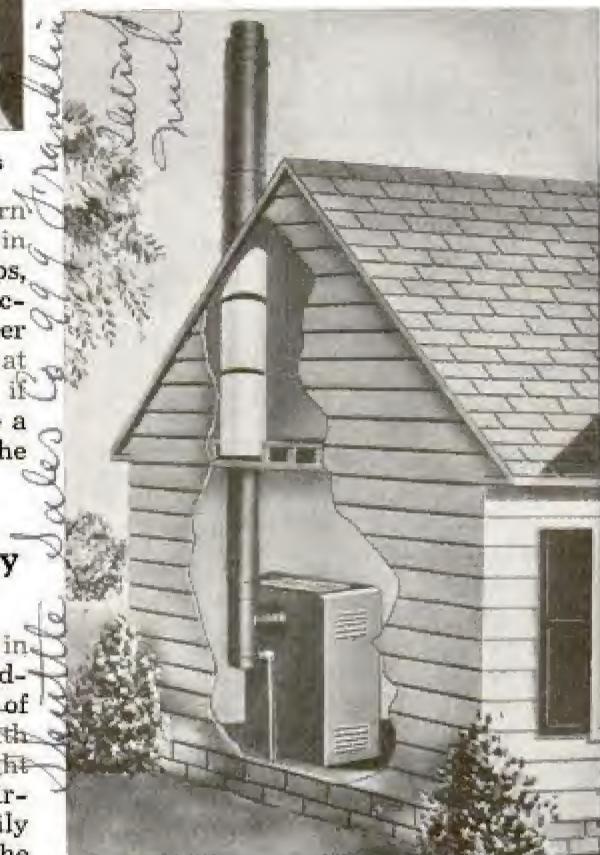
Just one day's deficiency of vitamin A in your diet is enough to increase night blindness, Dr. C. W. Brown of University of California found from experiments with ten students. In order to avoid this night driving peril, automobile drivers and airplane pilots do well to include in their daily fare foods containing the A vitamin. The tests showed that, after eating foods high

Scenic Service
10/15/41

in vitamin A content for 12 days, one group of students averaged 18.03 seconds in recovery from glare blindness, while the second group, which omitted A-containing foods from their diet took 22.70 seconds to regain vision. In determining the extent of night blindness, a light was flashed in front of the students for a short period and the time required to recover vision in a dimly lighted room was measured. After the initial test, the first group was switched to foods deficient in vitamin A, and within one day they began to lose their more rapid recovery ability. Some of the foods rich in vitamin A are carrots and sweet potatoes, green vegetables such as lettuce, peas, green beans, cabbage, also eggs and milk.

L1135 Metal Chimney for Gas Furnace Reduces Building Cost

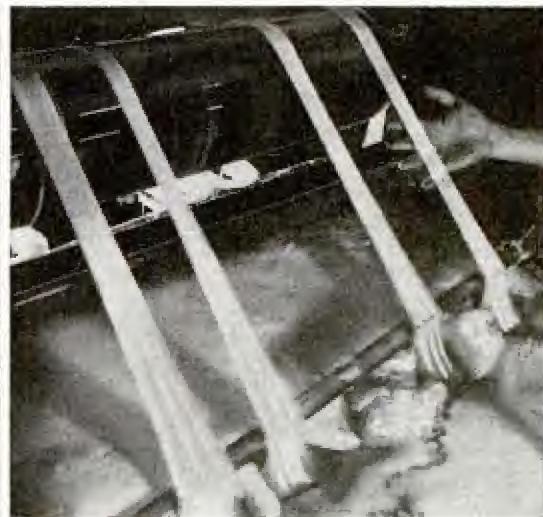
Where gas is used to heat the home, the cost of building a brick chimney can be avoided by installing instead a less expensive welded-seam metal chimney which is coated with acid-resistant vitreous enamel. This coating resists weathering and the attacks of the products of combustion.



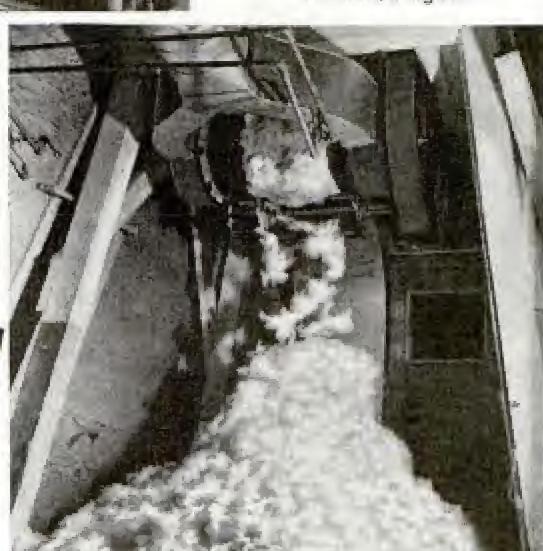
Enamel-coated metal chimney resists weather and acid

21246

Spring Dresses to Be Woven From Cow's Milk



Thousands of strands of "Aralac" fiber make up the four topes above, emerging from spinnerets. The hand in upper corner shows how translucent this new textile fiber is. It is processed from cow's milk. In the vat at left, resembling a huge washing machine, the fiber is squeezed under tremendous centrifugal pressure, and then is washed again



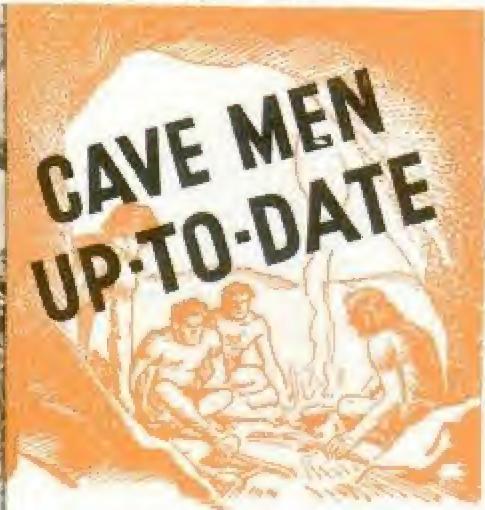
Already felt hats are being made from fibers derived from the casein in America's skim milk surplus, and by spring there will be slacks, dresses and other apparel woven of textile fibers developed by National Dairy Products Corporation. This fiber can be blended with mohair, wool, cotton, rayon or fur. The finished fluffy fiber above is ready to be pressed into 450-pound bales. The picture at left shows a spinneret through which honey-like viscous casein is forced under hydrostatic pressure, emerging as strands of fiber. One new use for the fiber is to protect hair during permanent waving

Aralac, Inc., Jay Trilly, Linn

2112 C.R. John & Co., County, Rye Beach,
Huron, Ohio



↑ An amateur "caver" maps an underground cavern; paper and pencil, chalk and tape are essential equipment. A principal purpose of the Speleological Society is to gather accurate data on caverns



At the mouth of a cave, above, a party takes notes over the telephone from a group exploring deep in the earth. Two quarter-mile spools of telephone wire are carried

One slip and "caving" would be ended for the enthusiast at right. There is a deep pool just below the slippery ledge, only a few inches wide, on which he is crawling

FLASHING his light against the roof of the cave, William J. Stephenson shouted: "Look! This ceiling's coming down! A while ago I couldn't touch it with my paddle; now I can."

He was leading a party of amateur "cavers" exploring Gandy Sinks, underground river in West Virginia. The spot of light on the ceiling disclosed bits of weeds, grass and leaves.

"Out of here at once," Stephenson ordered, and 20

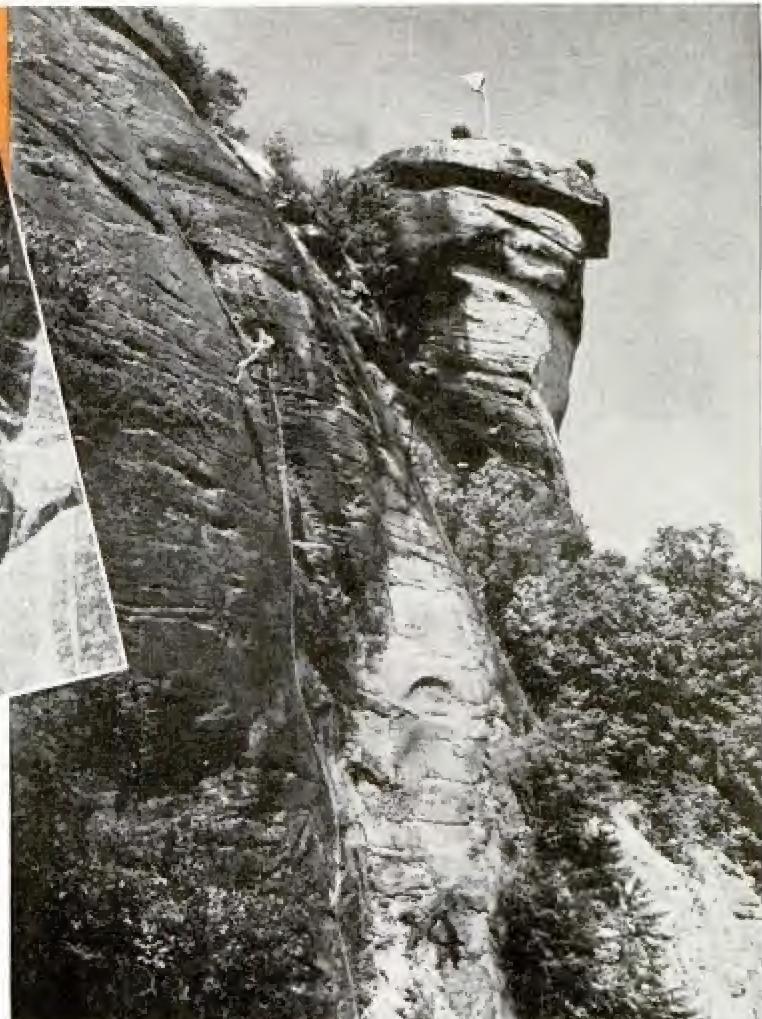




Stringing telephone cable in a
cave in Bald Mountain, N. C.

minutes later they sighed with relief as the little exploring craft sped out of the river's mouth. A few minutes longer and they would have been trapped and drowned like rats. But Stephenson, who is president of the Speleological Society of Washington, D. C., organization of amateur cave explorers, had noticed a heavy rain cloud as the party started underground and was alert for rising water.

"Cavers," whose hobby is one of the most unusual and least known, practice utmost caution and always go well equipped. They carry both spiked and tennis shoes for use on rock or slime. Hard hats, like miners' helmets, protect their heads against falling or jutting



Traversing precipitous face of Chimney Rock on way to cave opening

"Hard hats," similar to miners' helmets, should be worn in cave explorations to protect the head from jutting rocks and falling debris



(Continued to page 182)

L 11 47.

Illuminated Soldering Stand Has Built-In Magnifier



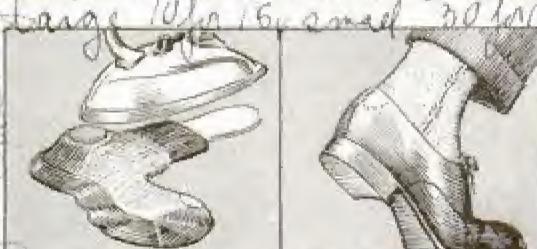
Soldering jobs handled under magnifier as in circle

More efficient and cleaner soldering can be achieved by using a stand equipped with a built-in magnifier and electric lights. Illumination from two bulbs is reflected by a white matte surface to the work which is viewed through a five-inch lens with either two, four or six-power magnification. A 30-inch chimney carries away fumes and heat. The stand takes a space 12 $\frac{3}{4}$ by 15 inches on the bench.

L 12 12

'Vulcanizing' Patches to Stockings Saves the Darning Time

Tedious hours of labor spent darning socks, as well as the attendant eye strain,



Flatiron presses patch on sock with neat result

Automobile Gas Look
ing Co. 218. Van
Dusen

can be saved by using ready-made patches which are "vulcanized" over the hole with a flatiron. A paddle is inserted into the stocking, and the worn part is spread over a small disk. Then a patch in a matching color is placed over the hole and pressed in place, the entire task requiring only a few seconds. Patches are available in various sizes and many colors.

L 11 48.

Handy Tabulator for the Car Keeps Record of Expenses

Keeping account of the gasoline and oil used and of money spent in operation of your automobile can be simplified by using a pocket-size adding machine now on the market. To operate the flat, oblong device it is necessary to keep in mind a few simple instructions. Each time gasoline is bought or money is spent, the amount is added by inserting a pointed pencil opposite the cor-



Calculator keeps record of car expense and gas used

rect digits, one at a time, and moving them to the top or bottom of the column according to the instructions. The final total is always shown at the top of the column. Two columns are provided, one for entering dollars and cents, and the other for number of gallons of gasoline or quarts of oil. A durable pin at the back provides means for fastening the device to the sun visor or other handy place.

Look in the index to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.

Racks Under British Bomber Carry Big Load

Running parallel nearly the whole length under the huge Stirling bomber used by the Royal Air Force are three bomb racks with trap doors which may be opened or closed as needed. In "bombing up" a plane for a raid over Germany, bombs are attached to a cable and hoisted into the racks by a motor.

L1232 Steam Boiler Could Shoot Water a Mile Into Air

It probably won't ever have to, but the new steam boiler of the Indiana and Michigan Electric company at Twin Branch, Ind., is capable of throwing a stream of water a mile into the air. The plant is as high as a ten-story building, and its steam-turbine generator is described as the most efficient steam-electric unit in the United States. Engineers estimate it will use only a pound of coal to produce a kilowatt hour of electricity, compared with 1.67 pounds of equal-quality coal in the average plant. In 1905 the average was 7.36 pounds of coal per kilowatt hour. Boiler pressure is 2,500 pounds per square inch, at 940 degrees Fahrenheit.

Christie Service Member



Acme
At "bomb filling station" cable and motor speed the loading of a raider

L1139 Molasses Is Made Into Auto Fuel of High Octane Quality

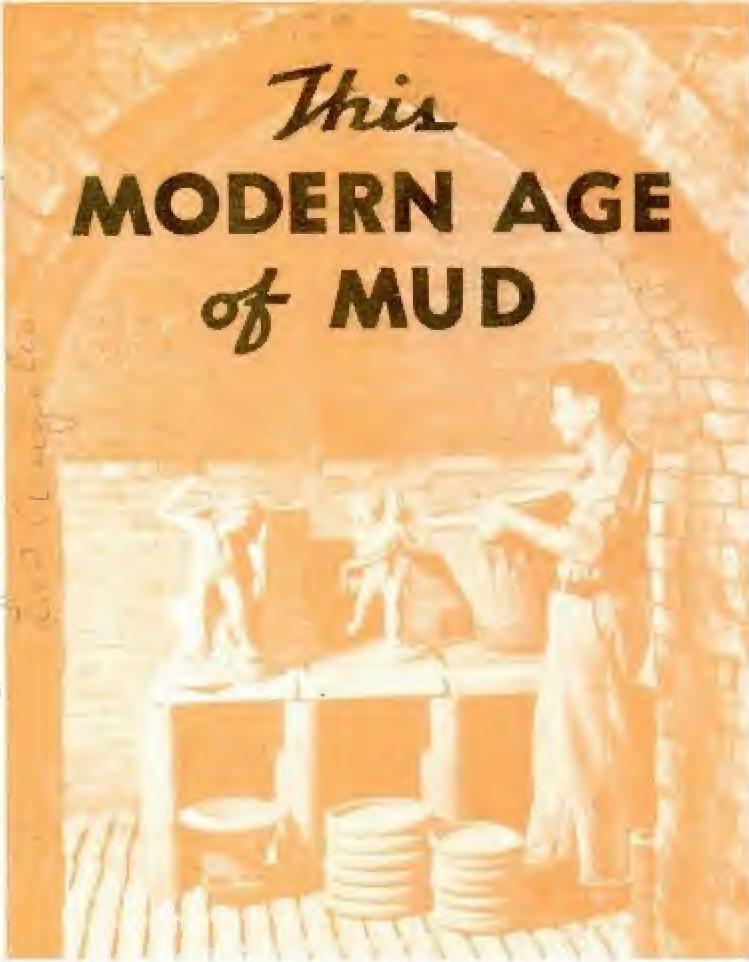
Automobile fuel with a high octane rating has been produced experimentally from blackstrap molasses by a newly discovered process. This discovery may open a new industry in the sugar-growing regions where blackstrap, the cane juice residue after the sugar has been removed, is to a large extent wasted. The blackstrap

is processed into butyl alcohol, then polymerized into a chemical equivalent of high-octane gasoline. It costs about 15 cents a gallon to produce at present, and could not compete with petroleum products except in sugar countries such as Cuba and Jamaica where there is a blackstrap surplus and imported gasoline is costly.

Ref: Wm. C. Christie & Co.
130 Clarendon St., Boston, Mass.
New York City
Tele. 6-1200

10/16/55

This MODERN AGE of MUD



Stacking terra cotta articles in a beehive kiln, ready for firing

A porcelain high-tension line insulator is turned to shape on a lathe



This ornate European porcelain ware is about 200 years old

CLAY, the original plastic, is one of the oldest, yet one of the newest materials used by man.

Begun as a crude art by uncivilized ancients, clay-working has helped make civilization what it is and today we build houses of clay brick, walk on clay tile floors, eat from clay dinnerware, and decorate our homes with artistic objects cast in clay.

In turn, civilization is finding new uses for clay and is constantly improving and refining it with the result that airplanes and automobiles owe their performance to the clay porcelain insulators of their spark plugs, electricity is transported for hundreds of miles with the aid of clay insulators that guard the high tension lines, and even television in part is made possible by the specially designed clay insulating fittings that keep its circuits sep-

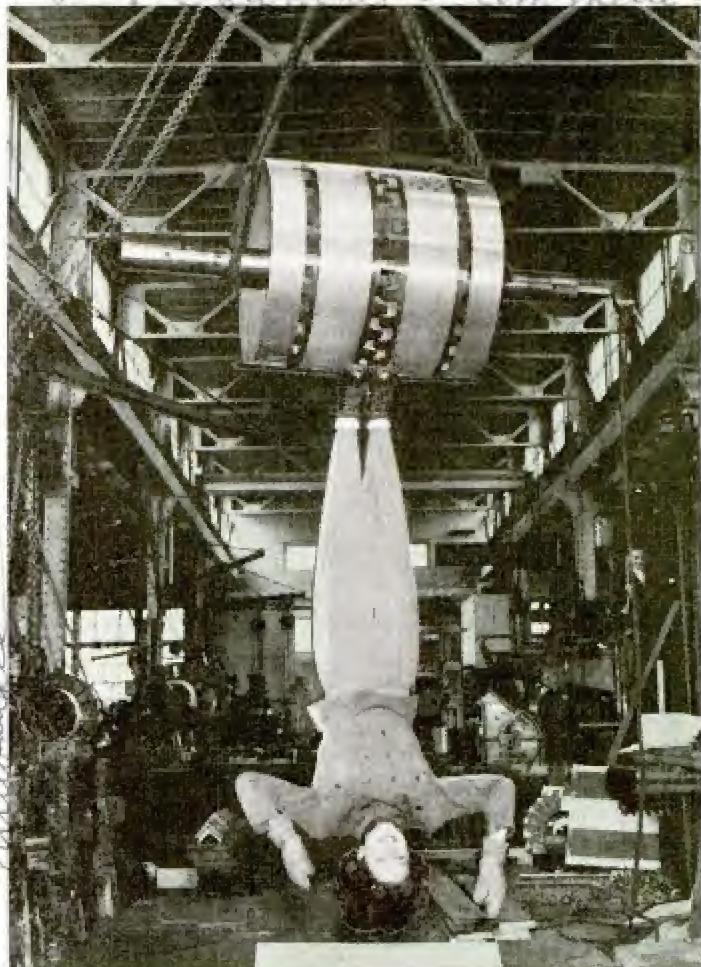
8056 New Ray Products of Nitrate
571 Chamber of Commerce Bldg.
Huntington

arated. Clay vacuum tubes 30 feet tall are helping in the search for atomic power. All in all, the Twentieth Century could well be called the modern age of mud.

In its widest sense, ceramics has to do with all earths that are fired in an oven and includes glazed and unglazed clay materials, terra cotta, glass, porcelain enamel, and even cement. Most of these substances are easily worked, have considerable strength, are fireproof and impervious to moisture, are indestructible as far as the elements are concerned, and are nonconductors of electricity. It is because of these properties that they are so widely used today. America, long a leader in developing structural and electrical clay products, is now competing with Europe in perfecting fine dinnerware and artware.

The mud that a porcelain worker selects for producing insulators that will hold 220,-

Photo at right 600 lb. each
Copyright Dings Magnetic Separator Co.

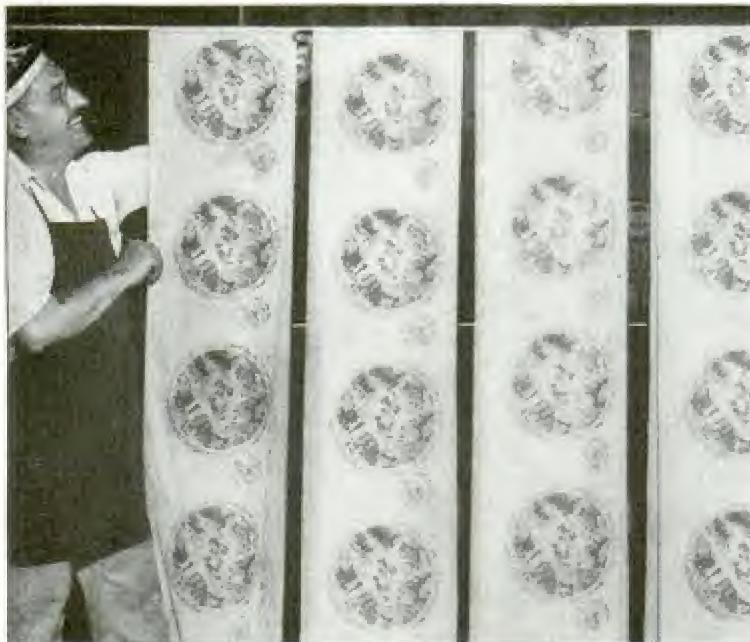


Clay cakes from which water has been squeezed preparatory to making porcelain line insulators ↓

Magnetic pulley wheel, used to ↑ remove iron particles from clay, supports girl by iron in shoes ↓

Fluorescent tubes being filled with liquid phosphors which coat the interior to produce light ↓





Dinnerware designs are printed with mineral paints on tissue paper

000 volts in leash, or that a potter mixes to make quality chinaware are vastly different materials from the common mud that the first craftsmen dug from a riverbank and molded into bricks and jugs. Ceramic bodies today may be compounded from half a dozen or more different clays carefully selected for strength, density, shrinkage rates, and other qualities. Some of the glazes that protect and add beauty to clay objects consist of rare minerals that are sought after in many parts of the world. Alumina, talc, and silica may go into an ultra-high-frequency insulator, and such materials as selenium oxide and lapidolite are used among others for adding color to glazes and porcelains.

Even the lowly common brick has been transformed into an object of strength and beauty, the latter being due to new architectural treatments. Clay is often passed through a vacuum chamber for de-airing, the result being a denser, more uniform plastic that is then pressed into structural clay tile, roof tile, sewer pipe, face brick, paving brick, or common

These are samples of plates in paint room of a modern American pottery

brick. New shapes and indentations for common brick, together with the use of reinforcing steel in laying them up, make possible sturdy earthquake-and stress-resistant construction.

Refractory bricks and shapes that are used to line furnaces and kilns now last two or three times longer than before because of new raw materials that are used. Light-weight fire brick, especially needed for marine installations, is manufactured by mixing ground walnut shells and sawdust into the clay. These particles burn out when the bricks are fired in the kiln, leaving minute air spaces that insulate as well as save weight.

Similar research is responsible for the fine types of chinaware that are on the market today at prices only a fraction of what such ware used to command. Most dinnerware is first shaped on automatic jigs, then dried in warm air, then goes into the kiln for preliminary firing. Here the clay is burned into a strong but porous body called biscuit. After cooling, underglaze decorations are applied either by





Porcelain insulators receiving a
100,000-volt flash-over test

Workman removing plaster of
Paris form from terra cotta statue →



hand painting with special mineral paints or by transferring printed designs from thin tissue paper. The ware is then sprayed with glaze material and goes back into the kiln for a more intensive firing that turns the glaze into a permanent glasslike surface. This, in general, is the way chinaware is made though numerous variations of the method are used for obtaining various effects.

Twenty years ago most good china came from Europe but now American potters are equaling the best. America led the style change away from the conventional white ware and is specializing in dinner services in attractive solid colors, in pastels, and most recently in two-tone effects.

Similarly, American designers of figurines, flower holders, and other art objects have struck out for



Spraying color on a figurine, typically American in simplicity and humor

(Continued to page 172)

g 1110

Portable "One Track" Bridge Carried by Soldier



Same
Soldier carries bridge section overhead as he crosses ditch on another

Light enough for one soldier to carry on his shoulder, a bridge section consisting of two tubular girders, which is used by the British army, speeds the crossing of small streams. Each span is a narrow channel, and two of them properly spaced form tracks over which vehicles and equipment can pass with ease.

100

Black and White Film Projected As Natural Color Movies

By a simple but revolutionary process black and white film can be projected as color movies, using special lenses in the camera and projector which were developed by Prof. Lucien-Henri Roux, member of the Institute d'Optique of Paris. Both the camera and projector are fitted with a lens divided into four equal sections, each

section being in a different color—red, green, blue and yellow. Pictures are taken on a single film in black and white, but the color filters give each a different depth of blacks and whites. In projection the four images are cast on the movie screen, being exactly superimposed so they make a single image. The colors are strikingly natural. The method permits showing news reels in color as soon after the event as black and white movies, and it is much cheaper than the processing of color films.

£ 10 9

Self-Locking Link Mends Broken Skid Chain

Quick repair of a broken automobile skid chain is possible with a self-locking link which can be hooked to the severed ends without tools. The link cannot become unhooked or unlocked while it is taut, and the spreading of the tire plus the motion of the wheel prevents it from slackening.



Hooks open when slack, left; lock when taut, right

L1194 : Contr L H Houck, 5911
Eustace's Tampa, Fla

Plane Model Teaches Correct Use of Controls

To aid in teaching student pilots how to fly, a Florida air school demonstrates problems in flying with a model airplane fitted with a set of standard controls. Placing the tiny ship in a certain position in the air, the instructor asks the students to set the controls as they should be in actual flight. Another method is to adjust the controls to a given setting and require students to place the model in the position such a setting would give a flying plane. Instruction in all manner of maneuvers and acrobatics, is thus simplified for beginners.



L1097
Students demonstrate correct use of controls with aid of airplane model

Bamboo, Called Most Useful Plant, Finds New Application in War

Choosing bamboo as the world's most universally used plant, Dr. Willard M. Porterfield, Jr., of the U. S. Soil Conservation Service declared there is not a category of human needs which cannot be supplied by bamboo or its product in some form. Articles made from it include food, weapons, shelter, implements, clothes, furniture,

baskets and containers, bridges, conduction pipes, paper, cable and ornaments. The war in Asia has brought out some unusual applications. To protect buildings from bombs, Chinese construct a three-story bamboo framework on top and pack it full of bamboo. When a bomb hits, it explodes before reaching the building.

Flying Bombardier Lies Prone to Help Gain Accuracy



Acme.

Keen-eyed Canadians, being trained in the highly specialized art of dropping bombs with deadly accuracy from dizzy heights, undergo many months of schooling. To direct his missile at a target, the bombardier lies prone on the floor of the plane as he peers through the bomb sight, keeping a tense thumb on the release button.

Hairey.
Face downward in the bottom of his bomber, this Canadian student flyer keeps a keen eye riveted to the bomb sight, with his thumb ready to release a bomb

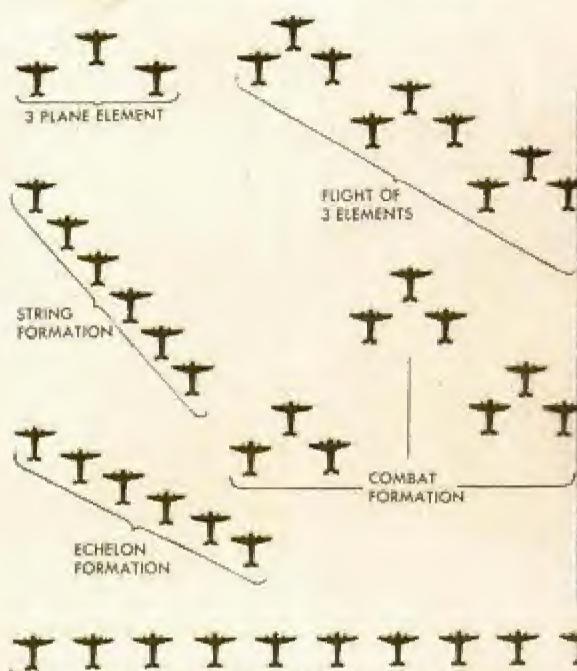
D 818

3872 Franklin &
to Anyplace

SPEED DEMONS of the AIR



Pilot sighting through electric gunsight. Below, formations used by pursuit plane groups. Note the formations employed in combat



STRING, ECHELON, AND LINE FORMATIONS ARE USED CHIEFLY IN DRILL

By Thomas E. Stimson, Jr.

"Z-1 TO DOG 10. Hypo 28, high. 217 degrees. Target six heavy bombers. Acknowledge."

Dog 10, the leader of a dozen pursuit planes on patrol guard at 9,000 feet, acknowledged the radio message and opened his throttle, pointing his plane in the direction he had been instructed to fly. The rest of the squadron fell in behind. On his map the leader located Hypo 28, the area in which the bombers were reported. It was 60 miles away.

Soon another radio message came in and Dog 10 changed course to the left. The interception service on the ground was tracking the invading bombers as they flew inland and each time the bombers changed course, new instructions went out to the pursuits; guiding them closer to their target. Finally



Mechanics wearing gas masks as they install .50-caliber machine gun on pursuit plane

2078.

FORCES



one of the pilots located the hostile planes and he spoke into his microphone, alerting the leader and the rest of his squadron. "Dog 21. Target 45 degrees right, below." The leader rapidly estimated the best method of attack, gave his orders over the radio, and the dozen pursuit planes tilted downward toward the bombers. There was only a fraction of a second in which they could fire as they hurtled past, then they reformed and climbed for another stab at the bombers.

Pursuit planes are the best defense against enemy aircraft but the pursuits have to close in on the enemy before they can knock him out. Helping them to do so is the job of

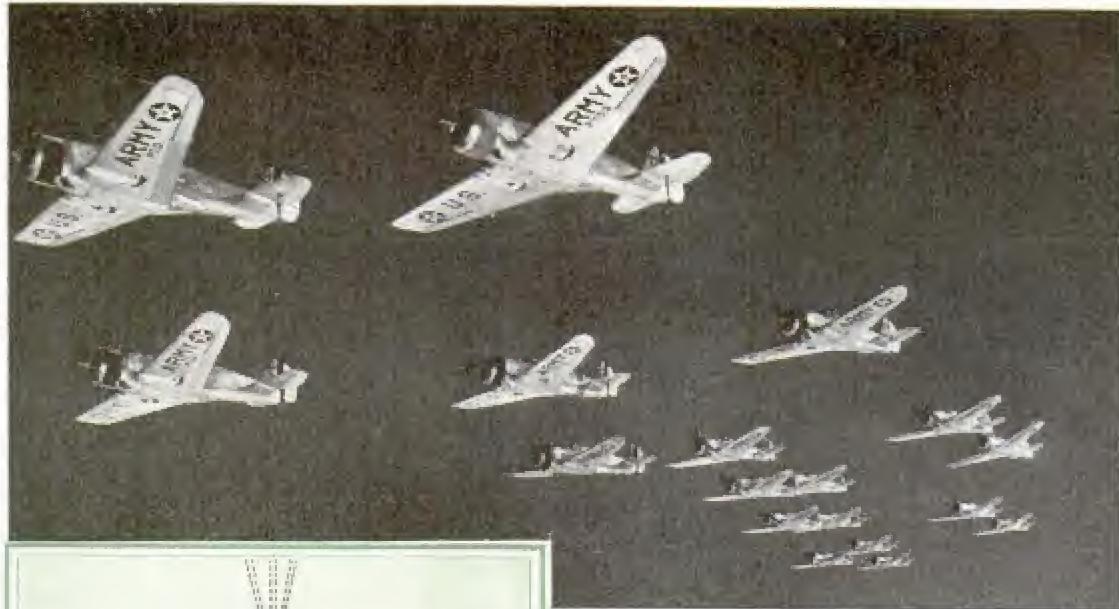
Loading .50-caliber ammunition into guns of a pursuit ship

Pilot turning selector switch controlling guns to be fired



Ref: Capt. W. G. Evans. U.S. Navy. Selected by
March Field Cavalry

8816



↑ Formations of pursuit planes at high altitude. Combat levels are rising and fighting today is at 15,000 feet and higher



DIAGRAM SHOWS HOW ALL GUNS ON PURSUIT PLANE ARE POINTED SO THAT THEIR FIRE COMES TOGETHER IN FRONT OF PLANE AND THEN SPREADS AGAIN



Northrup seaplane fighter with two machine guns. Lower gunner lies on stomach to fire

the interception service. Scores of observers spotted over the countryside telephone in when bombers pass overhead and the interception service plots the path of the bombers from this information, then radios the pursuit leader the course to fly to intercept them. Radio orders are in simple code. This week the squadron leader's name may be Dog 10; next week he may be called Apple Five or Cat Six.

Tracking down their targets in this way is one of the training exercises of pursuit groups such as those based at March Field, Calif. Gunnery is next in importance and day after day the pilots fire at towed sleeve

targets, small panels set up on the ground and shadows. Shadow shooting is one of the most realistic of all exercises and to do this one airplane flies over the water in such a way that its shadow is seen on the waves below. The other planes use this shadow as the target, diving and firing and observing the splash of their bullets while the speeding shadow turns and dodges.

Accuracy is what counts. In shooting at a panel target on the ground, simply hitting the panel isn't enough. The pilot must pour shots into a small bullseye, just as in actual air battle he must hit vital parts of the enemy plane instead of merely shooting holes in the wings.

The pursuit pilot is literally the superman of the air force. Pilot, navigator, radio operator, gunner—he must be his own four-man crew. Acrobatics and tight formation flying are the rudiments of his training, but they aren't as simple as they used to be because the high speeds of today's pursuit planes are a complicating factor. A pilot uses all the speed he has to catch up with another plane, then he has to slow down to fight. The pilot who can make the tightest turns is most often the victor, so he slows down a bit in order to turn sharper. He still maneuvers so fast that he blacks out in some turns, though he can train himself to reduce the interval of this unconsciousness both by practice and by tightening his stomach muscles as he goes into the turn, pushing his chin down tightly on his chest and shouting at the top of his voice.

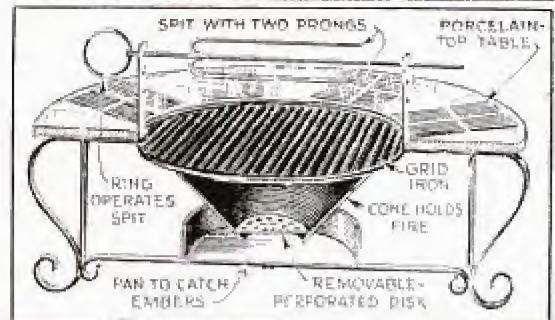
Add to all this the fact that most air fighting today is at a minimum of 15,000 feet and much of it at 30,000 feet and higher where the lack of air slows down all his reactions, and you begin to see that a pursuit pilot has to keep himself in tip-top physical condition. Calisthenics and handball are as important parts of his daily routine as is flight training.

In single combat a pilot must be a rugged individualist, yet half his fighting is done in formation and when he is part of a formation he has to follow the leader without daring to use his own initiative. In a formation fight he doesn't even aim at the target and he fires his guns only when told to do so. The leader of the flight aims his own plane at the target and gives a radio signal for the others to fire. The leader knows that the other planes, hugging his own wings, are pointed in the same direction that he is, and that their bullets will be as effective as his own.

High speed, too, has affected the science of gunnery. It is almost invariably true that a pilot will never hit a target that he catches squarely in the center of his electric gunsight. Instead of aiming his plane like a rifle he has to point it like a shotgun,

(Continued to page 173)

1198
not white
and
Barbecue Table for Indoors Burns Smokeless Charcoal



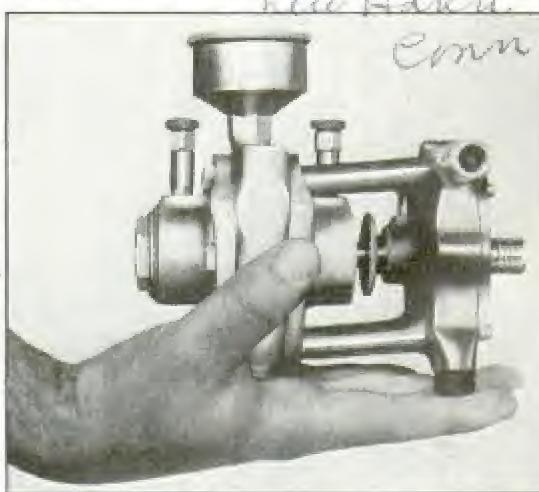
Indoor barbecue table cooks meat on spit or grill

You can bring the spirit of camping right into your home with an indoor barbecue table of porcelain. In the center is a gridiron over which a two-pronged spit, turned by means of a ring, holds the meat to be roasted. The fire is encased in a steel cone, embers being caught by a pan below. Charcoal is used, to avoid smoke.

Cloud Charge Indicator for Plane Warns of Lightning Peril

Airplane pilots can tell when they approach dangerous thunderclouds by fitting their ships with a "cloud charge indicator." The delicate instrument consists of a neon tube and microammeter. These are connected to a pointed tungsten rod protruding, like a lead pencil, 14 inches from the plane, which picks up electrical discharges from clouds and sends them through the instrument. This flashes the neon tube and deflects a needle on the meter.

Tiny Explosionproof Pump Operates by Air Pressure



Pump operated by air eliminates danger of explosion

To safeguard workers where volatile liquids or inflammable gases are handled, a tiny explosionproof pump operated by compressed air has been designed. It weighs but 10 pounds, measuring 5½-by-6-by-7 inches and may be held in the palm of the hand. Operating on air pressures ranging from 20 to 100 pounds, which may be varied by controlling the speed of the air motor, the pump has a capacity of 7½ gallons a minute at the lower pressure and 15 gallons at the maximum.

~~Self-Inflating Rubber Duck Decoy Is Deflated for Carrying~~

Two hunters, wearied of toting loads of wooden decoys, drew upon their inventive talents to design a five-ounce, collapsible duck decoy, a dozen of which can be tucked



Rubber decoy takes little space when collapsed

into the pocket of a hunting jacket. When tossed on the water, the rubber decoy springs open, thus automatically drawing in enough air to make it float. Air is admitted into the body through an opening at the bottom where a heavy wire ring acts as ballast and keeps the hole from closing. If it floats too high, squeezing a little air out of the body will make it sink deeper; but if it is floating too low to look natural, more air may be admitted by lifting the decoy from the water.

2998.

Television-Camera View Finder Helps Improve Pictures

Television camera operators are now offered an instrument that enables them to see in the view finder the scene exactly as it will be picked up by the camera and



Television operator sees view as camera records it

transmitted over the air. It is called an electronic view finder, which corrects parallax or the apparent displacement of objects when viewed from different points. This condition is present in some degree with most film cameras where the view finder and camera lens are set at slightly different angles or separated positions. The new finder has its own power supply and uses a five-inch cathode-ray tube that forms a finely focused image on either a green or white screen. According to the manufacturer the unit also serves as a focusing means and as a monitor to aid in correcting faulty images at the camera.

21161 Scale Model of "Sub Cheater" Makes Trial Run

Trial runs were made recently with a one-third-size working model of a revolutionary type cargo ship which is designed as a challenge against submarine blockade. The 1,900-ton ships will be 270 feet long and will be propelled by a six-foot propeller sunk amidships. Sixteen gasoline engines will supply the power. Antiaircraft batteries will be installed on the vessels, known as "Sea Otters."

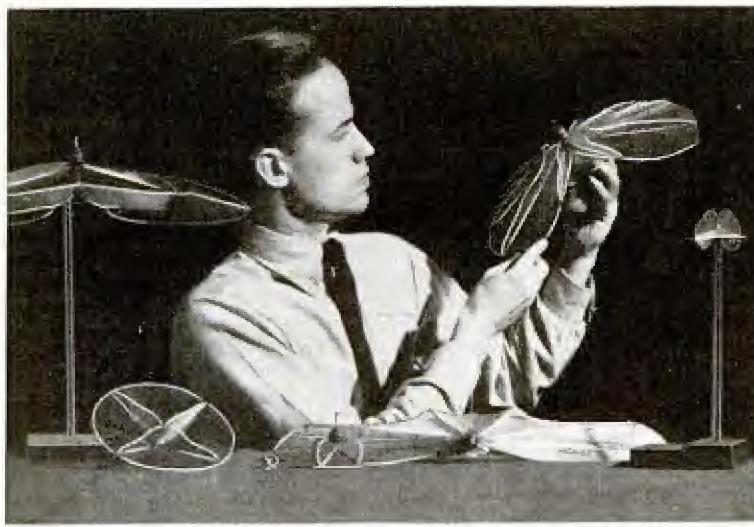
Built for testing purposes, this working model of the "sea otter" is one-third of full-size

21036



21036

Plastic Models of Light Show the Range of Street Lamps



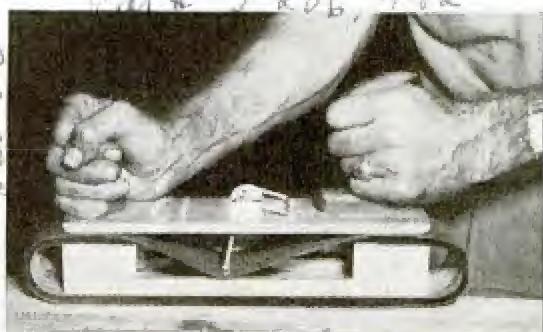
These translucent plastic models show how far street lamps spread light

Models of so intangible a thing as light are being made of translucent plastic by engineers at General Electric Illuminating Laboratory in Schenectady, N. Y. Called Photometric Visualizers, they show in three dimensions the light distribution from luminaires used in modern highway lighting. A model for each lamp design gives a lucid view of both the amount and direction of light which will be cast by the lamp it represents.

21164 Lightweight Metal Hand Sander Has Time-Saving Release for Paper

Sandpaper can be inserted quickly in a time-saving metal hand sander equipped with a trip lever that releases the paper immediately when it is raised. The tool uses band belt of a standard size, and two screws on one side permit adjustments that tighten or loosen the belt. The only nonmetal parts in the sander, which weighs less than two pounds, are wooden grips.

Lever on top of sander releases hold on sandpaper for easy adjustment or replacement with new belt



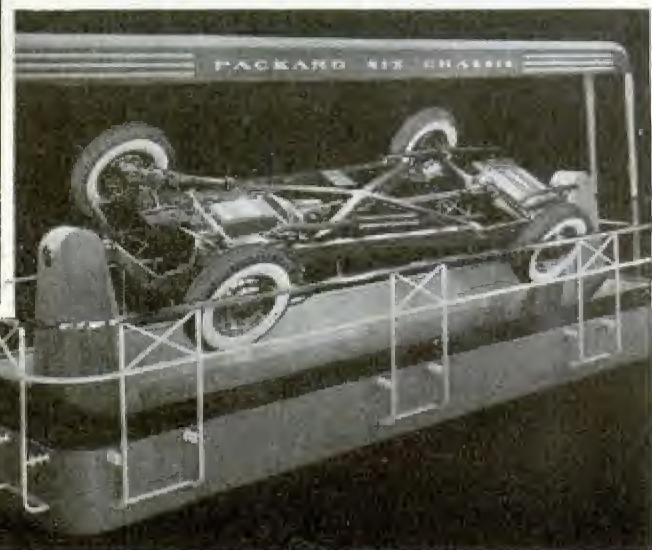
7-1951
Laggett

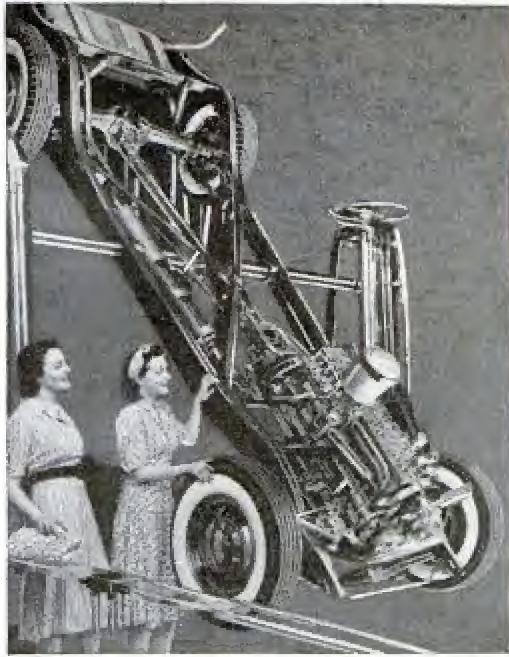
CUTTING 'EM UP TO SHOW 'EM



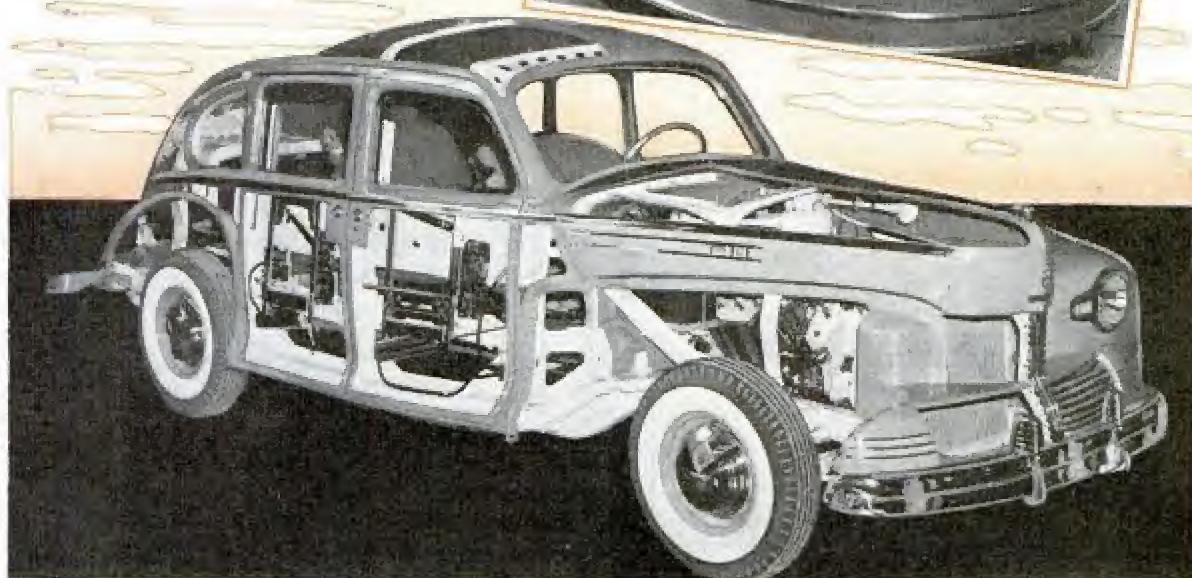
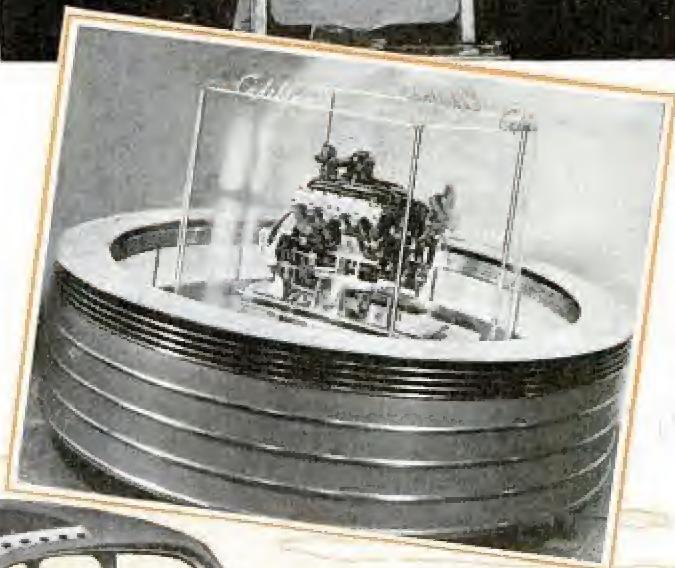
Running mechanism of an automobile can be inspected closely by means of this arrangement—a chassis complete with engine but lacking fenders, hood and body. It is mounted so that it revolves slowly, showing top, sides and bottom. At the moment this Packard Six was snapped, it was bottom up.

What makes the wheels go 'round is interesting to almost everyone, so the automobile industry has been working out ways of showing clearly how various parts of the modern car operate. Engines have been built that open like a book, cars have literally been cut in two and whole sections have been stripped from some models—the better to show what goes on. Above, a Pontiac constructed to open up automatically, giving onlookers a view of the engine and of space in the driver's compartment. At left, a "book motor" that opens and closes itself like the leaves of a book—and operates during the performance. Thousands of man-hours went into its construction.





And this chassis (above) rotates, end over end, in a spectacular demonstration. Note how it is mounted in carefully balanced position on the horizontal bar. Top, right, a Cadillac V-8 engine split crosswise. It automatically divides and each half completes a full revolution while pistons, valves and other working parts continue operating. Center, a Cadillac engine set up like a rare gem in a jeweler's box. Bottom of page, cutaway chassis showing a Lincoln's unit-body-and-frame construction. These showmanship methods have been developed through years of staging large automobile exhibits, most of which were cancelled last fall when the 1942 models gave up the spotlight to national defense



"Walking" Tank of Water Has Its Own Cup Supply



Jacket insulates water tank as it makes the rounds

Equipped with a faucet and a supply of paper cups, a "walking" water tank makes the rounds of factories and outdoor work crews, bringing the drinking water to them and saving time taken out from machines to go to a drinking fountain. The five-gallon insulated tank is strapped comfortably to the water boy's shoulders.

Hand-Saw Cover Guards Teeth And Prevents Rusting

Accidental contact with the teeth of a hand saw can be prevented by fitting it with a metal guard now available. Made of copper-plated dead soft steel, the guard is arched in such a way that it touches only



Guard held against saw teeth by spring steel wire

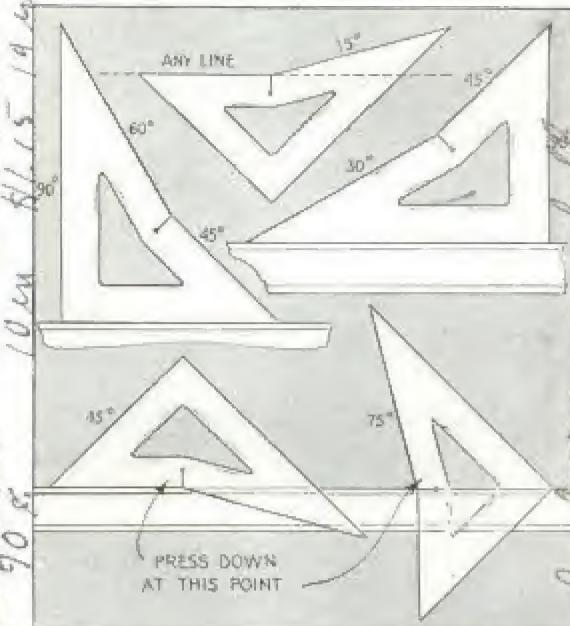
Ref: R.W. Sherman
Editor • Architectural Record
Record 1194 + 84 NY
extreme front and rear points but covers all the teeth. It is held in place with a spring steel wire clip while the saw is not in use. The channel may be filled with vaseline to prevent rusting.

L1139

Most Home "Traffic" Accidents Occur on Porch and Stairs

Porches and outside stairways are the locale of the most dangerous "traffic" accidents in the home, according to a report to the National Safety Council. Despite popular assumption that falls in the bathroom make it the most hazardous room, it has the lowest percentage of accidents among rooms and is only one-seventh as dangerous as porches and outer stairs. It is recommended that these places be protected by guard rails, nonslip treads, adequate light and a minimum of changes in grade.

Triangle Provides Six Angles With or Without T-Square



Sketch shows various settings to draw six angles

Used with or without a T-square, a transparent triangle now on the market draws angles of 15, 30, 45, 60, 75 and 90 degrees and eliminates the necessity of carrying two triangles. Angles can be drawn to a base line or any other line in the drawing. A slit in the center of the triangle permits it to overlap the T-square in using the extended angle.

L 1170

Amphibian Tanks Haul 40 Men on Land or Sea



(Photo by U.S. Navy)
Land-and-water tanks plow through sea at nine miles an hour; they can run at 25-mile clip on land

Troop-carrying amphibian tanks being built for the United States Navy were recently put through their paces in the Gulf of Mexico by Marines, who reported the craft easy to handle in mud or water and capable of going anywhere land tanks can travel. The sea-going tanks, invented by Donald Roebling of Clearwater, Fla., can

carry 40 men at nine miles an hour in water and 25 miles on land. Originally developed as a means of getting assistance to communities marooned by hurricanes, the tank was equipped with track-laying tread which had large cleats serving as paddles in water or mud. The Navy's machines are 20 feet long, 8 feet wide and 6 feet high.

L 1018.

Motorcycle Sidecar Ambulance Speeds Injured to Hospital



acw

Swift ambulance is created by mounting stretcher on motorcycle sidecar

Capable of transporting a patient at 90 miles an hour, a motorcycle-driven ambulance was demonstrated recently to civilian defense officials by the inventor, William E. Detler, of Detroit, Mich. The vehicle consists of a seven-foot ambulance mounted as a sidecar with a new kind of spring suspension.

Write to the firms listed in the Where-to-Buy-It index when you want more information about products described in this magazine. Say You Saw It in Popular Mechanics.



The SHIP that NEVER SAILS



↑
Trainees load a four-inch broadside gun while other apprentices aim it at ships passing the New York island

← Seamen practice with hand winches for lifting and lowering lifeboats from the deck of the training "ship"

THEY call it the ship that never sails. Day after day the seas pound its sides and the wind whines through its rigging. Its lifeboats sway in the breeze. Smoke from its stack drifts over New York harbor. Its cargo booms swing up and down incessantly as though feeding a bottomless hold. Its modern guns are always ready to growl defiance at the thousands of craft which slide past, but the command of "Fire," is never given, except in practice.

Its crew of 658 men, alert and disciplined, down to the last man longs for the feel of Atlantic swells beneath their feet. But the ship that never goes to sea is anchored by wood and steel piles to a reef

8896 Cont. Allen Warren Elliott
343 & 33d year.



Top, left, scrambling up to the crow's nest of the ship that never sails; right, studying mechanism of three-inch gun in classroom

between the tip of Brooklyn and Staten Island. It will never move.

For this ship is merely a dot in the waves, an island of seven and one-half acres—Hoffman Island—little known even to the average New Yorker and practically never heard of beyond the city. By queer coincidence it is shaped like a ship, with pointed bow, parallel sides and rounded stern. Yet it is important in America's maritime destiny, for from here go the crews trained to serve aboard United States liners and cargo carriers—able seamen, who, seven months before, were clerks, farm lads, college students, or high school graduates still wondering which career to pick.

The island "ship" is training mariners for Uncle Sam, teaching them seamanship that required three years apprenticeship at sea in the past. True, their education will have been forced along by wartime expediency, but those sailors will be worth their salaries, ranging from \$72.50 to \$84 a month, plus living quarters and food, to say nothing of bonuses paid on ships touching certain dangerous ports. One of these bonuses hit an all-time high recently when \$500 was awarded every

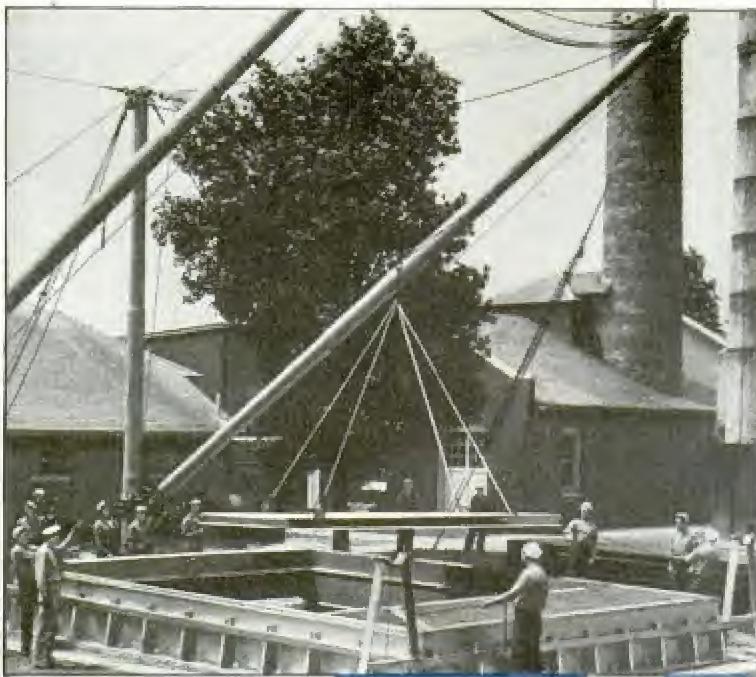


Two maritime fleet apprentices, above, practice signaling. This is the semaphore for "W." Below, a gunnery class studies guns on model of "North Carolina"



maritime service Warren Elliott
Hoffman Island, NY

Chief Gunner's mate
E. J. Grier Coakley



[†]
Cargo hatch is an exact duplicate of that of a freighter, even to booms, winches and cover—but its hold is four feet deep

Coast Guard Lieut. C. I. Steele shows how to use signal searchlight like → those used on Uncle Sam's liners and freighters

Its very outline resembling that of a ship, this is the Maritime Service Training School located on Hoffman Island, N. Y.
↓



crewman on a ship headed into a war zone.

If they were not competent, they would have been weeded out early in the training course by the officers loaned to the island organization by the United States Coast Guard, headed by Commander George E. McCabe and Lieut. Commander William J. Austermann. Up to now, an average of 14 percent has failed to make the grade.

Early in the present emergency, the pressing need for cargo ships was recognized by Washington officials. Vessels were ordered by the hundreds. New shipyards were built, old ones reopened. But soon officials began to wonder who were going to man all these vessels. If there is anything more important than the ship itself, it is the type of men who operate her, and good seamen are so scarce today as to threaten the nation's welfare in time of war.

So the United States Coast Guard, which could



1891

2/11/24.

Auto Vacuum Sucks Poison From Snake Bite Wound

furnish excellent instruction and administrative personnel, was requested by the Maritime Commission to administer the U. S. Maritime Service and produce thousands of seamen who deserve the description "ablebodied." But ships are scarce and these perilous times are not propitious for sending green men aboard any craft which sails the deep. So the little speck of artificial land that once had been a quarantine station was taken over.

The result is the grass and cement "decked" ship, Hoffman Island, where men from 18 to 23 who have had a reasonable amount of education are learning the ways of the sea, the twist of a rope or the feel of a deck gun. Their textbooks are nothing like the ones they studied back home. They deal with the intricacies of gunnery, the stowing of cargo, the handling of machinery, fire extinguishing, the use of gas masks, lifesaving and in general the ways of the sea in these times of modern ships and modern wars.

They "cram" at their lessons willingly, because only three months at the training station are needed before the successful ones are placed aboard a training ship for four months of actual experience off the American coasts. They know that 6,000 jobs are now awaiting the ones who make the grade, divided as follows: 40 percent for deck work, 40 percent for engine room work and 20 percent in the steward's department.

The apprentice steps from a stripped-down former Coast Guard patrol boat to behold an island looking very small in the wide expanse of the sea, and equipped with a variety of docks, slips, towers, masts, guns, cargo booms, offices, school buildings and red brick barracks. The first week or so he learns to make up his bunk, care for his clothes, keep his locker orderly. In this period he also gets acquainted with his fellow apprentices, examines the island ship and its many devices for training, receives rudiments of discipline, which is not as strict as in the armed forces, begins to get his muscles in shape with exercise, and takes the antitoxins which are necessary if he is to sail to tropical ports.

The second week he is likely to find himself in the galley of the good ship Hoffman Island, picking up the tricks of waiting on tables, baking, broiling, boiling, roasting and frying. He is also shown that spotless



Cups use auto vacuum to draw venom from wound

Vacuum created by the automobile engine is now being used for treatment of rattlesnake bites. Invented by Geo. K. End, who cans rattlesnake meat at Tampa, Fla., the outfit consists of two glass cups and a length of rubber tubing that attaches to the vacuum system of any automobile in place of the windshield wiper. This permits the automobile engine to suck out the poison. The fang marks are first criss-crossed with a razor blade.

2/12/24 — Bumper Extending at Side of Car Prevents Hooking Onto Others

Bumpers are prevented from hooking at the ends, and greater protection is afforded in case of accident, by adding extension bumpers that skirt the sides of the automobile fenders. The extensions, made in the thickness and width of regular bumpers, are finished in colors to match the cars and add to their streamline appearance. It takes only 30 minutes to install them, and one unit can be removed in 10 seconds for changing tires.



Side bumpers guard fenders and wheels from scrapes

(Continued to page 164)

1092

Phone Set Does Its Own Dialing When Lever Is Pushed



Pointer (inset) and lever make telephone call without dialing

Considerable time can be saved with a telephone set that automatically dials the number wanted. You set a pointer at the name of the person to be called, press a lever, and the instrument does the rest. The phone is offered in two styles, one providing the automatic feature for 12 phone numbers, and the other for 52 stations.

166

Mildew Proofing for Fabric Lasts Many Months

Cotton and other fabrics can be made highly resistant to mildew by an inexpensive and nontoxic process just developed at the U. S. Bureau of Home Economics. Valuable for home as well as commercial use, the treatment has no effect on the appearance, color or pliability of the material and remains effective even after five washings and after six months storage. It can be applied to sails, awnings, shower curtains, tents, tarpaulins and similar articles subject to mildew. The process



Ladder and platform can be folded quickly to a compact bundle

depends upon forming an insoluble compound between morpholine—a complex organic compound—and certain inorganic salts, principally those of cadmium and copper. This compound is formed right in the fabric, by immersing it under specified conditions in a solution of cadmium or copper salts, then in morpholine.

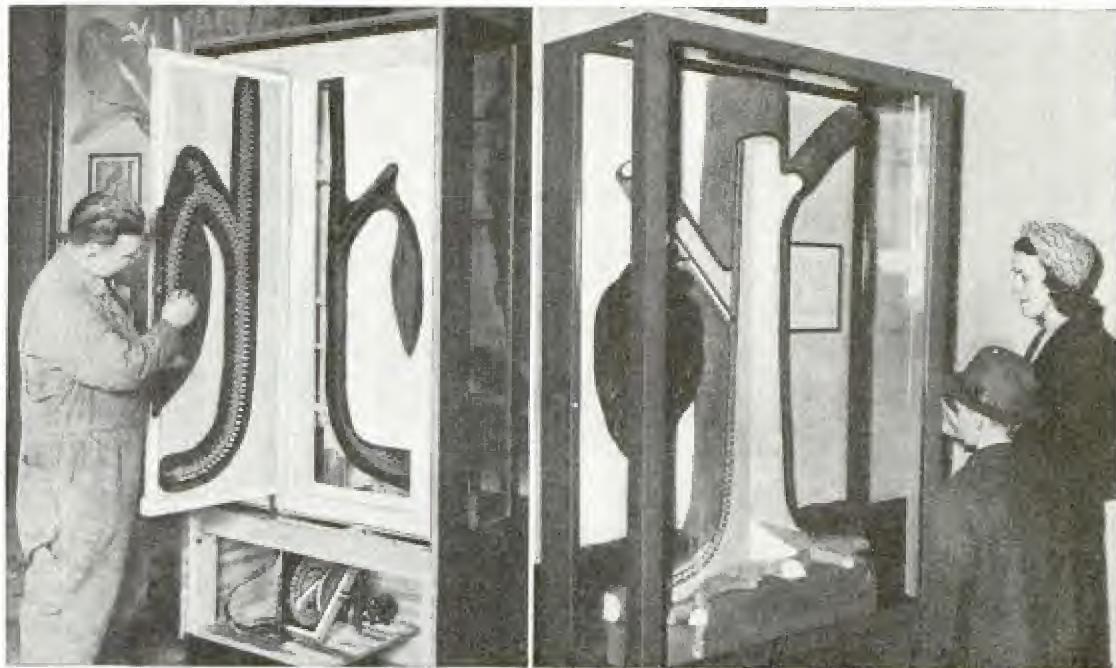
1158

Platform on Erect Ladder Rises as Worker Climbs

Mounted on a tip-proof base, a mobile ladder with an elevating platform provides a working height of 17 feet, which is especially useful in building-maintenance work. The platform, weighing 25 pounds, is fitted with shoulder straps with which the workman carries it up and down like an elevator as he climbs the ladder. It may be anchored at any height by hooking it to the ladder rungs. Easy to move about, the scaffold rolls on rubber-tired casters, two of which can be locked by built-in brakes. The entire unit weighs 195 pounds.

81120

Light Flows Like Sap in Animated Tree Model



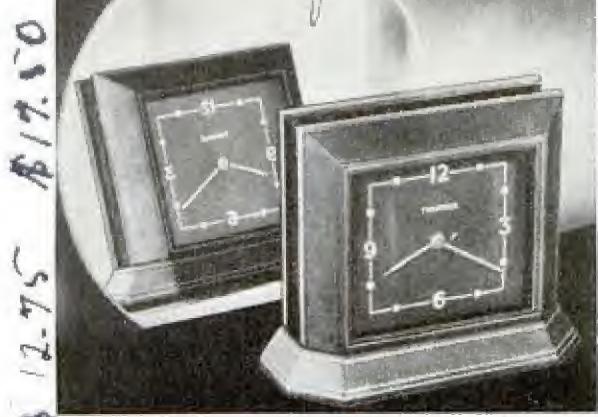
Courtesy, Buffalo Museum of Science

Left, checking up 6-volt light bulbs behind model; visitors, at right, see how fluids flow in tree

2966
Animated when a visitor presses a button, a new exhibit at the Buffalo Museum of Science represents a section of a tree trunk and its roots, indicating by a series of colored lines the system of channels which carries vital fluids between the roots and leaves. Press the button and on goes a procession of 214 lights illuminating these channels of sap which seem to flow up and down throughout the tree. The lights are mounted within colored glass tubes. A red one moving upward represents water and dissolved minerals absorbed by the roots

and taken to the leaves and fruit. The downward movement, amber colored, shows the passage of the food manufactured in the leaves. Although the result is a simple portrayal of tree life, the mechanism is a complex maze of eight pounds of wire and 48 electric circuits, the operation of which is coordinated by a rotor flasher driven by an electric motor located in the base of the cabinet. Only eight of the lamps burn at one time, four indicating progressive motion upward and four downward through the tubes.

Table Clock With Two Faces Handy for Home or Office

Twin face

With a face on two sides and lacking the usual unsightly nuts, bolts and knobs, a table-type clock is decorative when set in the open in any room, not needing to be backed against a wall. Actually it has no back, but is two clocks in one, with two standard dials and two sets of hands operated by a single mechanism. Placed between twin beds it ends bickering as to which bed it shall face. Its two-way feature likewise is suited for use on an executive's desk in an office. A specially designed reversed gear keeps hands working together in a clockwise direction.

Mirror behind clock gives a view of the other face

81120-208
The Hobart Co.
1501 Av. New York

9939

HITCH-HIKING on the



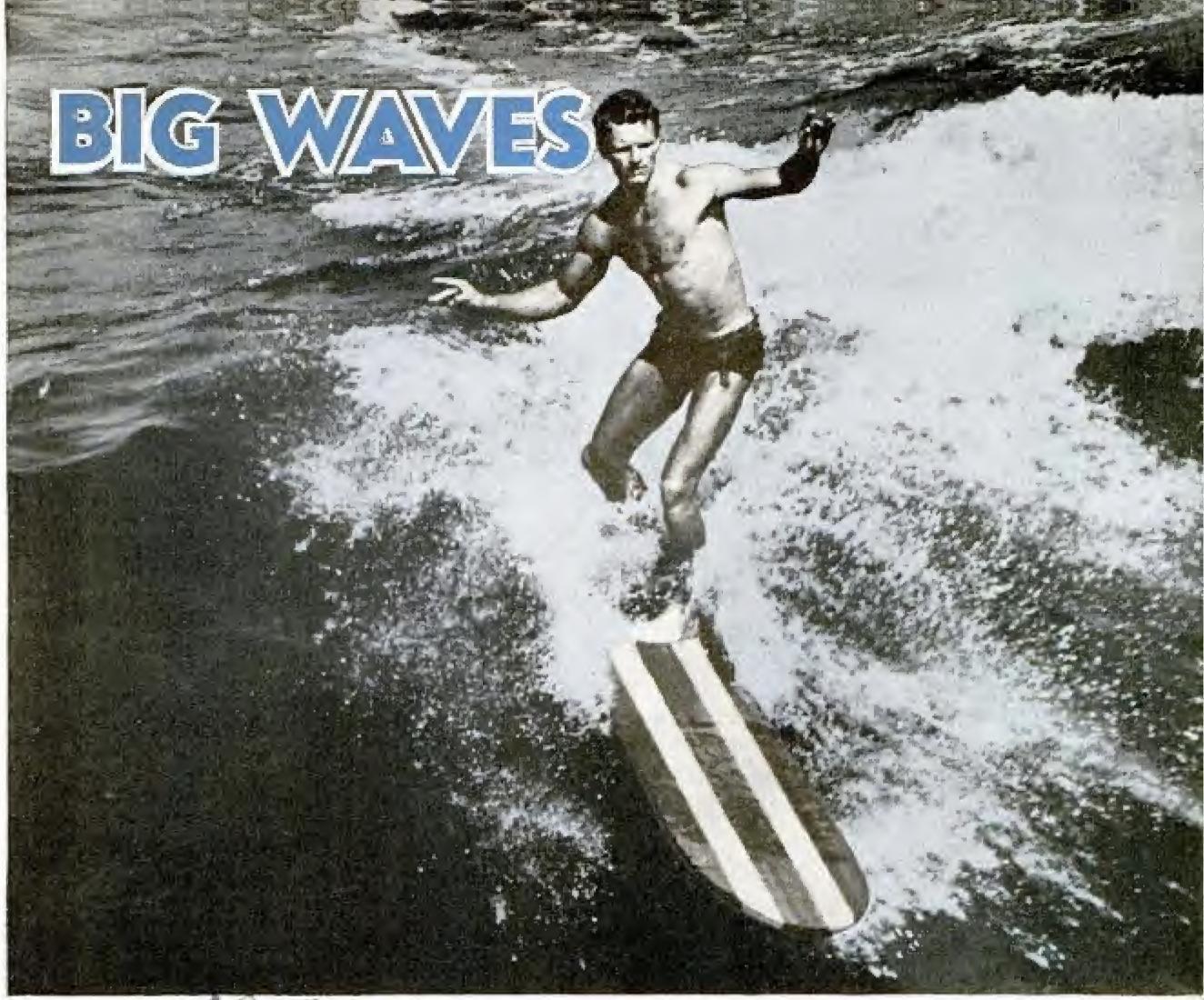
↑
Here we go! One rider has just caught a "peaking" wave and the other is about ready to get it. The wave is only four feet high at this point

Rusty, perched on the end of the board, is a surfing fan and is widely known → on the California beaches for his love of the sport

Two riders have caught this wave; a third seems likely to take a "pearl dive," but skillful handling might get him going
↓



BIG WAVES



1937

Beginners get their first experience in quiet waters, where they learn to propel and manipulate their boards. No one dares try surfing before he has learned this—it would be as much as his life was worth. Even a small roller descending on an unmanaged board might produce a serious spill.

Steering is done in one of two ways. Either the foot is dipped in the water, or the rider leans far over; sometimes both. The preference is often governed by how the board is built. Propelling is not a job everyone can do; many persons are not strong enough. The rider

When white water closes in, it's the rider's cue to head for safer spots

To avoid "clean up," rider shoved board through wave, and as it rose in the swell, he leaped over crest and is coming down safely on other side





lies flat on his board, and strokes with both arms in the form of the American crawl, except that the arms move in unison, rather than alternately. This is a powerful physical developer, as a glance at the torso of any surf rider will tell.

After the novice has learned to paddle and guide his board, he is ready to try one of the smaller, or "nursery" surfs. Now the fun—with the bruises—begins. He launches his twelve-foot board, and cautiously starts to make his way "outside"—that is, the region where the waves start to "peak up." The chances are overwhelming that before he reaches the outside, he will have been soundly "cleaned up." This happens when a big one comes along, and the rider is not able to get through it. So down goes our beginner, head on the bottom, feet in the foam, while churning water whirls and beats half the sense out of him. Some quit right there, but a real fighter will come up half drowned, grab his board and



↑
As this wave peaks rapidly, the rider turns, partly by using his hand, partly by leaning, getting him out of zone threatened with a clean-up

← If you think surf-boarding is a gentle sport, take a look at what is left of this board after one of those big waves gave it a going over

Right slide by the tilting technique enables rider to evade clean-up. You can imagine what would happen if he were caught by wall of water pounding perilously near at the rider's left
↓



start again. Presently he will learn that when a clean-up comes, he may get through it by careful maneuvering—and if not, his cue is to get off that board, dive under the wave, retrieve his board wherever it may end up, and try again.

Finally, he will manage to get outside safely, without getting "the works," as surf riders and onlookers gleefully call it when someone gets smeared by a clean-up. After a short wait outside, a good wave generally comes along. He hastily lines up his board by dragging one foot while he paddles simultaneously with both hands. The roar is on him. He tries to stand up—and boom! Down comes a mountain of foam, soft and fluffy, and gentle as a herd of elephants. Over and over goes our novice, bumping on the bottom, until he knows he will never live to tell the horror of it.

But live he does, and if he still has the courage he tries again and again until he at last rides a wave. He has done it! He rides a dozen in succession, perhaps, without once getting cleaned up.

Now bring on the big ones!

The waves he has ridden so far have been perhaps four to six feet high. At a few spots along the coast, where the real surf riders gather, anything under eight feet is regarded with contempt. You don't really do any bragging until you have ridden one of those twenty-foot swells.

But the beginner is now ready to try them, or he thinks he is, so off he goes to one of the famous surf beaches, probably at Palos Verdes or San Onofre, and in high excitement he launches his board. Perhaps half a mile or more off shore, the waves are forming. They look like mountains, but far outside he sees a group waiting, and sets out to join them.

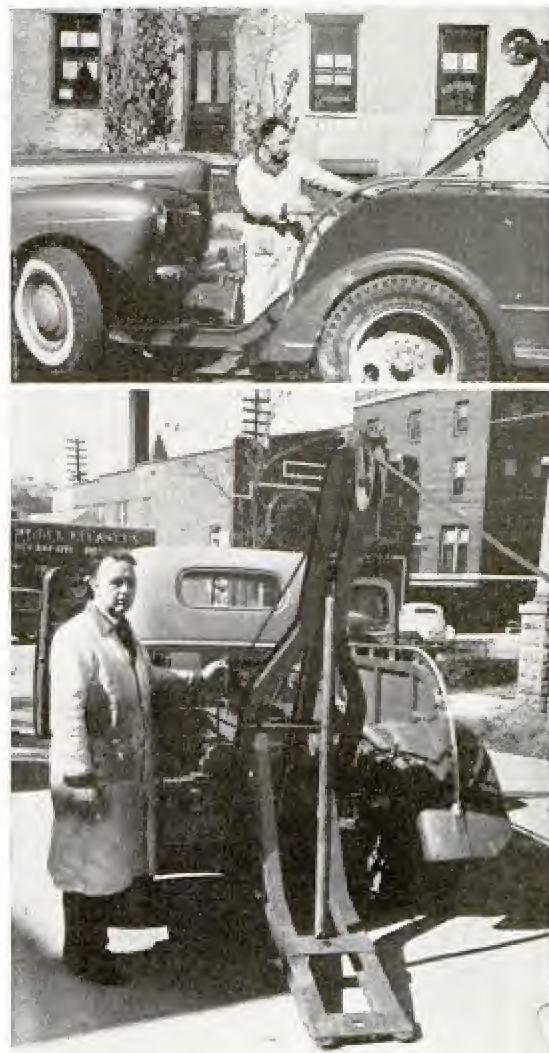
Let us hope he arrives without getting the works. The chances are against it; these waves are killers. Out there he finds a bronzed, chatty gathering of veterans who give him the critical eye of appraisal, and discourse on the particularly vicious quality of the swells this day. Suddenly there are cries of, "She's humping!"

A hundred yards seaward, the entire ocean seems trying to stand on end. The horizon is blotted by its mass, even distant clouds are obscured, and this roaring, hissing monster is bearing down on the frail boards with the speed of an express train.

For a fleeting moment, he considers div-

(Continued to page 166)

Auto 'Scoop' on Tow Truck Stops Swaying on Road



Upper view shows scoop lifting a car by front axle

Safer and more rapid towing service is made possible by a scoop-up wrecker vehicle. A long arm at the back of the truck slides under either knee-action or conventional cars, picking them up by either the front or rear axle with ease and in a minimum of time. The disabled car is held rigidly in a turntable on the end of the boom which insures proper tracking and protects the car from damage. No high rigging is used and it is not necessary to carry extra anchors or supports.

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Mobile Engineering "Lab" Stages Science Show



In the top scene, students see "northern lights" created by a 15,000-volt charge shot into the rarefied gas of vacuum tube

At the lower left, cases of scientific equipment are loaded aboard mobile laboratory for a tour of Pennsylvania

Below, a student hangs from iron disk held by a magnet powered by a flashlight battery. It could support 400 pounds



Carrying vivid lessons in chemistry and physics to classes throughout the state, mobile laboratories have been touring Pennsylvania under the sponsorship of the State College. During last summer alone two of these traveling "labs" covered nearly 20,000 miles, staging scientific demonstrations before 10,000 students enrolled for special defense training courses in 100

centers. In one "show," students watched man-made "northern lights" as a 15,000-volt charge sent molecules bombarding one another in the rarefied gas of a vacuum tube. In another an iron disk held by a magnet drawing power from an ordinary flashlight battery proved able to support 400 pounds. In the two-hour demonstrations, 36 basic experiments were performed.

Members of Club Pledge Their Eyes to Restore Sight to the Blind

Its members pledged by a legally binding agreement to donate their eyes at death to the living blind, the Dawn Society, sponsored by the International Order of Good Templars, has been organized in California to aid in giving sight to the blind. Doctors

have been successful in grafting corneas from one eye to another, and the society's aim is to give them enough cornea tissue to restore eyes blinded by damaged corneas but otherwise healthy. About five percent of all types of blindness come with-

in this classification, many being due to industrial accidents. Both eyes of the donor will be removed within six hours after death, and stored in a light saline solution under refrigeration. The tissues can be grafted up to two weeks after being removed, but because of the great demand it will not be necessary to store the eyes more than a few hours or days.

Submarine Cargo Vessel Towed by Warship

What looks like a huge football is the experimental model of a queer cargo vessel designed to be towed under water. The inventor, Gaston Desagnat, New York, offers the idea as a national defense experiment. Ships of this type, it is said, could be loaded with war material for Britain and towed behind warships or cargo steamers in strings of ten to twenty. Fully submerged, the craft would make a poor target for enemy submarines and airplanes attempting to destroy them. Built at the yard of Sound Marine and Machinery Corporation, Mamaroneck, N. Y., it has a framework of wood, covered with a coating of concrete which was sprayed on.



Concrete-coated submarine towed by warship, carries cargo under water

FEBRUARY, 1942 Constructed by Sound
marine & machinery Corp. of Mamaroneck, N.Y.

2/10/8 "Xylophone" Made of Rock Bars Is Tuned With a Chisel



Rock bars were chipped down until they gave the desired tone

His interest aroused in musical rocks when he heard beautiful, clanking tones emanating from stalactites struck across the middle, Prof. Edward L. Troxell, state geologist of Connecticut and a teacher of geology at Hartford's Trinity College, fashioned a xylophone in which rock is used in place of the usual wooden bars. Trap rock found in a million-year-old bed atop Avon Mountain near the professor's home proved to have the resonance needed. He gathered a load of the stones, set them in a row and with a chisel chipped each one until it produced the right tone, tuning them with the aid of a ten-cent pitch pipe. However, since "xylo" is derived from a Greek word meaning wood, the professor calls his rocky instrument a petrophone. It has a complete C Major scale three octaves long, on which he can play many pieces.

2/1/68 Cmt. Warner Ogden / Knoxville
2519 Coliseum Ave Tenn

SMOKELESS TOWN of ALL-ELECTRIC HOMES



plumbing; cedarized closets; dry crack-resisting construction; solid brass door locks; chromium bath accessories; a gravel driveway; a garage with over-the-top door; a sturdy foundation; a basement or utility room; poplar or pine hand-sanded, molded trim; long-life roof; beautiful

Nailing asbestos siding over
plywood on home in "smoke-
less community"

Meadow Hills

Automatic electric heating
unit being installed in a
Fonde-built home



SMOKELESS communities are a reality in subdivisions developed on the edge of Knoxville, Tenn.

Stewart Fonde, who is building homes-of-tomorrow and who is executive head of H. C. Fonde & Son, constructed one community known as Forest Court. The homes had various kinds of automatic heat; were weatherstripped and insulated, had tile bath and kitchen walls; linoleum drainboard with chromium trim; all copper

One of the all-electric homes—therefore smokeless—in Knoxville community. One difference from other homes is absence of chimney



11165

medicine cabinet; butted wallpaper; termite insulation; ample closets and cabinets. The prices of those first homes ranged from \$2,500 to nearly \$4,000. They sold fast, of course.

All the homes were electrically equipped throughout—electric ranges, electric refrigerators, electric washing machines, and anything else electric desired. Forest Court was intended to show that low-cost quality homes could be built, rather than to entirely eliminate smoke. Then followed communities in which smoke elimination, as well as modern low-cost quality homes, became important.

Highland Hills, "Knoxville's first smokeless community," was built. Most of the homes in it are electrically heated and entirely electrically equipped. Prices of the electrically heated homes began at \$4,450, complete with lot.

Then Fonde undertook

(Continued to page 171)



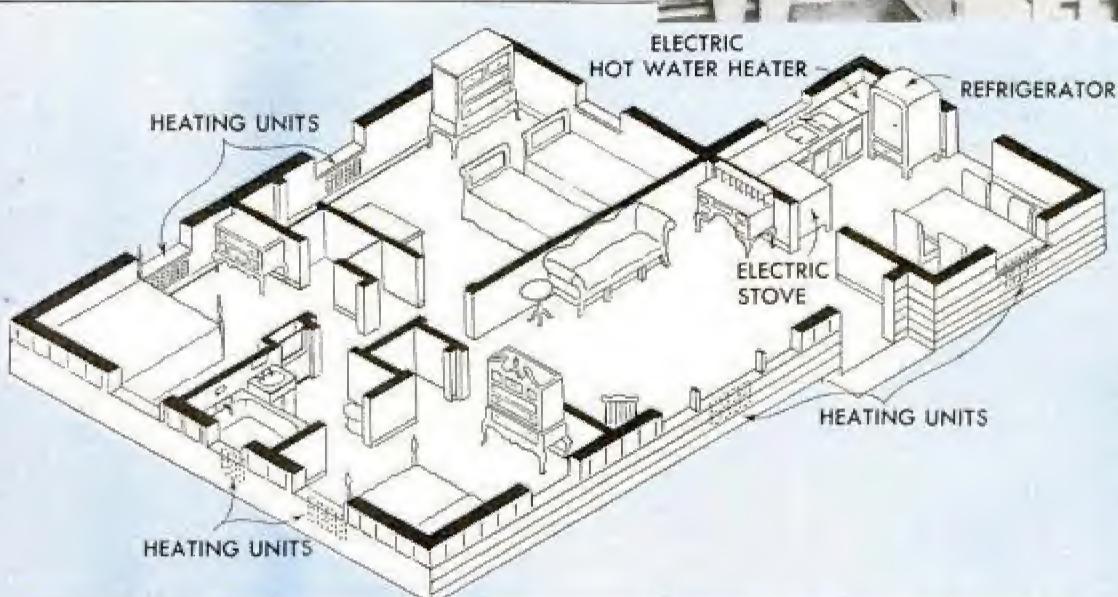
↑
Installing insulation
in all-electric house;
this work must be
done properly to hold
heating costs at rea-
sonable levels

Drainboard has a
portion of the side on
hinges so it can be →
pulled out and rested
on wooden arms

Simplified drawing of
Fonde house with
roof removed to show
the various electrical
appliances and the
location of electric
heating units
↓



Each Washes Face



L1083

Ton Crane Mounted on Trailer Lifts Engine From Plane



Trailer crane eases and quickens removal of airplane engines

Handling airplane engines has been made easier by a combination trailer and crane that can lift the engine from a plane and carry it about the airport. Designed by a staff member of Boeing School of Aeronautics of Oakland, Calif., the unit was constructed by Colson Equipment and Supply Company of San Francisco. The trailer has a two-ton carrying capacity and the adjustable crane can lift one ton. Vacuum booster brakes on the trailer are controlled from the steering column of the towing car. Legs at the rear are held in vertical position by a pin-in-slot and fold flat on the trailer when not needed. The front end is supported by a small wheel that may be raised while the trailer is in motion. The trailer-crane is 12 feet long, 8 feet wide and 14 feet high.

L1217

City Pigeons Are Put to Work Sorting Grain for Drug

Even the pigeons of New York have found jobs because of the war. They're sorting raw ergot from rye in a Staten Island warehouse. Ergot, a valuable drug, is obtained from parasite-infected rye ker-

nels, and before the war the infected kernels were sorted from the good by European peasants. Now the rye arrives in this country unsorted. Officials of the warehouse conceived the idea of calling on the pigeons for cooperation. They spread the rye on a table, opened a big window, and hundreds of pigeons flocked in to eat. They chose only the good grains, rejected kernels containing ergot.

L1021

Plastic Tape for Glazing Seals Out Water

Sealing windows permanently against the elements, a plastic glazing material applied like tape, with only a putty knife, requires no experience on the part of the workman. It consists of pliable plastic mounted on flexible lead foil, and because it remains pliable the material will not harden, shrink or crack. It is especially suitable for greenhouses as it can be raised in replacing broken window panes. The outer coating being of plastic, no putty or paint is needed, and if a portion of the tape becomes destroyed, a new piece can be patched in.

Metro-seal

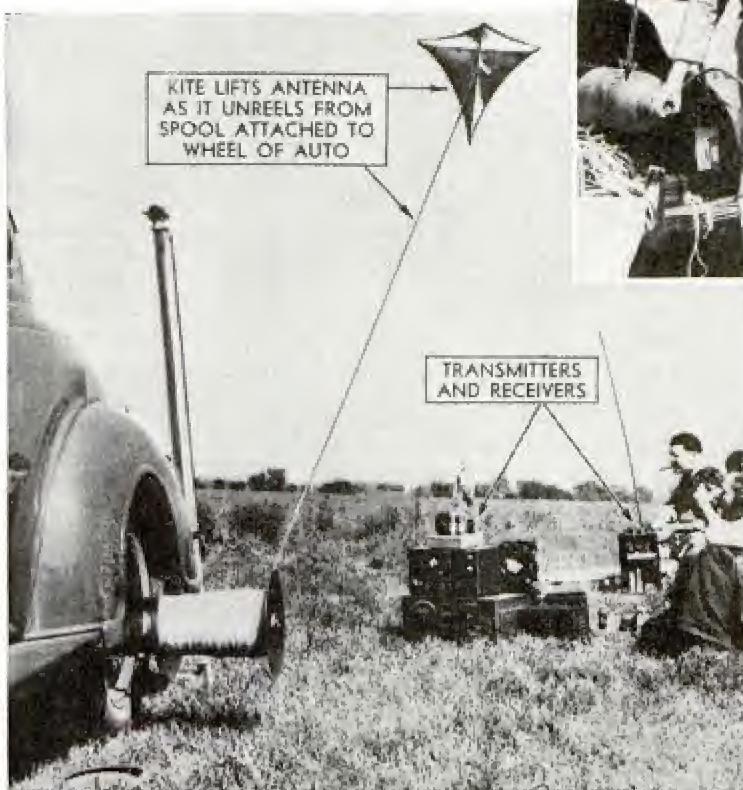


Glazing tape unrolls as it is applied to window

2-10-48

Balloon or Kite Lifts Antenna in Emergencies

Radio amateurs recently demonstrated their readiness to augment the nation's communication system with portable equipment whenever the usual channels are disabled. Two methods of erecting emergency antennas for short-wave radio transmitters were shown. From an automobile wheel hub a large kite carrying the antenna takes off at the end of 500 feet of chalk line with breaking strength of 130 pounds. The line is fed from a special reel



2-11-48 Acme

Hot-Dog Steamer for Home Has Automatic Heat Control

Three dozen hot dogs can be steamed at one time in professional manner for home parties with an electric steamer. An adjustable thermostatic control automatically turns off the current at the desired temperature, and switches it on again when additional heat is needed. The chromium unit makes an attractive stand when not in use as a steamer, and if a cake is stored inside it may be kept moist by placing water in the removable bottom.

To learn where to buy commercial products described in these pages, see the index.



Two methods used by amateur radio operators for erecting emergency antennas. Above, inflating balloon with hydrogen, and, left, sending up kite attached to spool mounted on auto wheel

fastened with the wheel's lug bolts, using engine power while the car is jacked up. A four-foot balloon inflated with hydrogen was also used. Having a lifting power of five pounds, the balloon can hoist an antenna several hundred feet into the air.



Thermostatic control regulates the temperature of electric steamer that heats three dozen hot dogs at once

*Consolidated
Edison*

top 41
Warren Elliott
new or old
Con. Allen



Specialists night and day hunt faults in 21,800 miles of power lines under New York pavement

Through vault, left, in a large office building, cables from the street are routed to upper floors

NEW YORKERS, accustomed to pointing with pride at the city's skyline of towering skyscrapers, have suddenly turned their attention downward — underneath the sidewalks they pound in the daily routine of their lives.

In other parts of the globe great numbers of urban peoples live like gophers, ready on an instant's notice to pop into a subway tube, a basement or an air-raid shelter. All the world knows that Gotham is the most shining target left for bombers on the face of the earth. So New Yorkers are discovering a striking fact: that as its millions of population packed themselves onto the narrow island of rock called Manhattan, they not only built their city skyward, but they also dug deep into the ground.



Unwinding from its spool, a new coaxial cable starts underground

New York Telephone Co.

POPULAR MECHANICS



Consolidated Edison Co., New York
A worker in a subterranean gas plant wields a mighty wrench

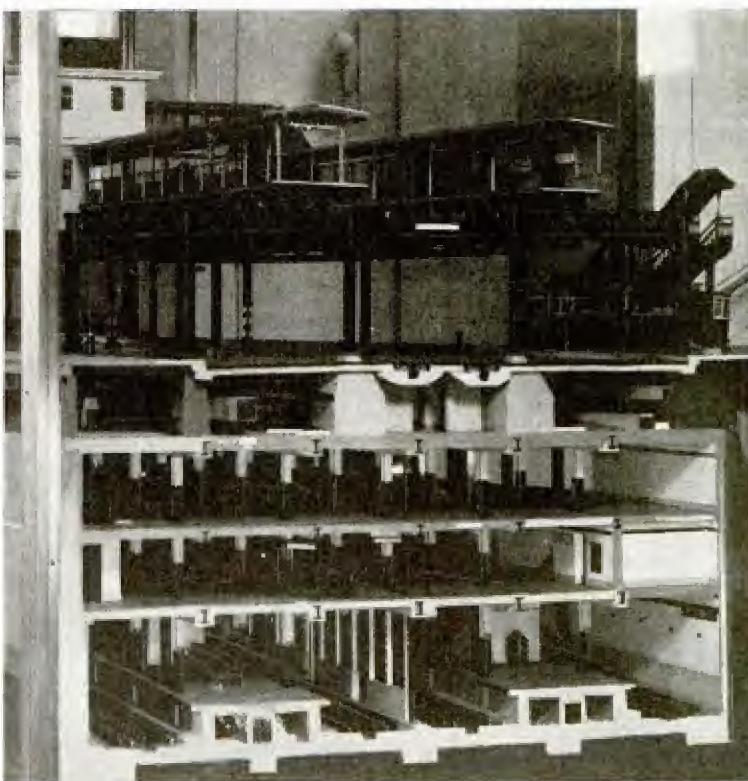
So crowded is the below-pavement space from building to building in some locations, such as Broadway at Times Square and at 34th Street, that it is actually impossible in places to insert anything as large as a broom handle between wires, cables, conduits, pipes and mains. The 322 square miles of city subsurface is so honeycombed with more than 1,100 miles of subway trackage, scores of miles of underground foot passages, vehicular tunnels and railroad terminals, that during the morning and evening rush hours it is estimated there are nearly as many New Yorkers below the sidewalks and streets as there are on them.

New Yorkers are aware of the transportation angle of what is underneath the sidewalks, because they are a part of it. But few realize the extent and importance of the maze of conduits, pipes and ducts which add up to 45,000



Reading meters that measure water passing through two 20-inch mains

Since this model of 34th and Broadway was built, the elevated and street car lines have been removed and a new subway added nearby



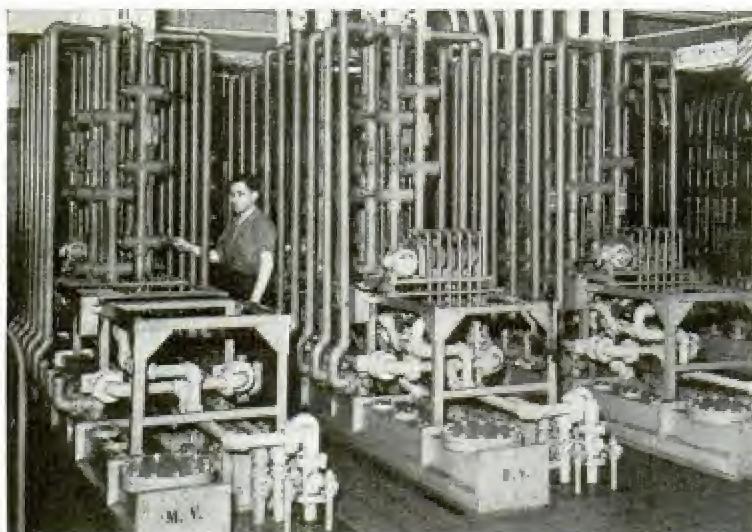
Franklin Institute photo

5 Times Bay Station, N.Y. Steam Corp.

P 841



Trouble shooters for Consolidated Edison company are underground one minute, high in air the next. Below, carriers containing eight telegrams travel 1,300 feet a minute in Western Union pneumatic tubes



miles, or the thousands of vaults, subbasements and private passageways which make the metropolis a human ant hill.

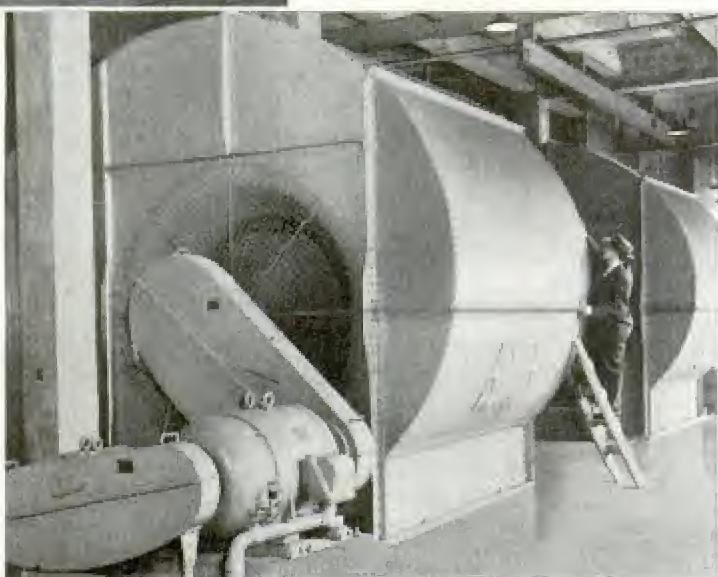
Round iron manhole covers on nearly every corner in the city, sometimes eight or ten to a corner, tell them that there must be a system of some kind beneath the concrete, but if a New Yorker were asked to locate the largest copper mine in the world, the chances are Montana or Chile would be mentioned. The fact is that the greatest single, concentrated copper supply in existence is right underneath their feet in incredible miles of cable, one util-

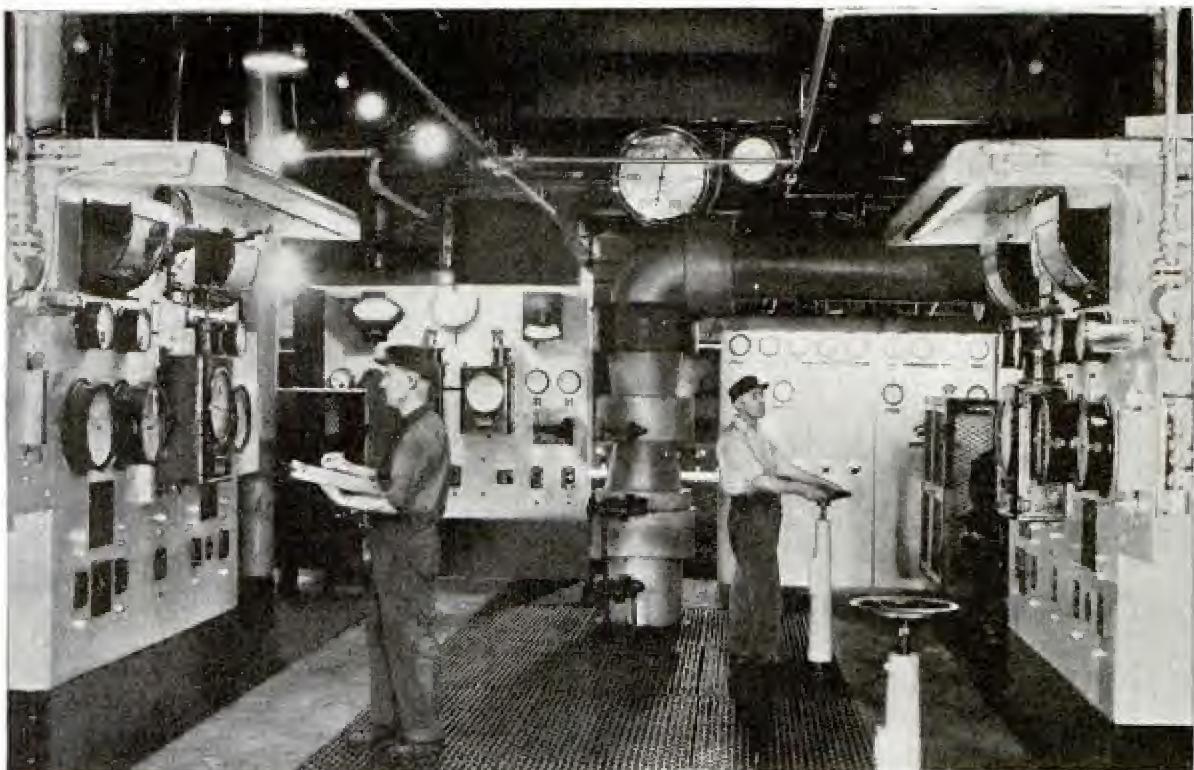
ity company alone owning 41,000 miles of electrical conductors. And four-fifths of some 9,400,000 miles of telephone wires run through the ground, as well as millions of miles more of wire which are a part of light, power, telegraph and alarm services.

The Consolidated Edison System alone, which sells most of the electricity for light and power, has installed subterranean lines containing 1,300,000,000 pounds of metal, including 118,000 tons of copper. This is sufficient copper to produce 37,500,000,000 pennies, more than five times as many as Uncle Sam has minted since 1792. Stretched into a wire, it would reach 3,700,000 miles.

This one corporation group has installed beneath the streets 400,000 tons of iron and steel, more than enough to build the San Francisco-Oakland Bay Bridge, and

Tunnel Authority inspector examines one of 23 huge blowers that change air 42 times an hour in Queens Midtown Tunnel





Space is so valuable and coal trucking so costly that most New York buildings have no heating plants. Steam is piped to them from Kip's Bay Station of New York Steam Corporation. This is its control room.

New York City's Triborough and George Washington bridges.

New Yorkers bathe without knowledge that 4,000 miles of water mains are needed to fill the tubs and 3,000 miles of sewers, many big enough to row boats in, carry the waste water off. They cook without realizing that it takes 5,000 miles of gas mains to connect their stoves with the huge plants and tanks scattered throughout the city. Yet, throughout the crowded area, every one of these necessities flows through the soil just under the skin of concrete on which the populace walks or rides.

From 6,000,000 to 10,000,000 letters shoot through the thin layer of dirt atop Manhattan Island daily, an average of about 500 letters contained in each 28-pound metal torpedo which is projected through tubes by air pressure at about 30 miles an hour. Mil-

New York
In a cable vault a telephone company lineman uses an exploring coil to locate trouble

lions of New Yorkers are ignorant of the fact that telegrams also speed under the streets in tubes. One of these is 12,500 feet long. In busy periods, carriers, each containing eight telegrams, are snapped into tubes, at 20-second intervals; thus a single tube can move more than 1,400 telegrams an hour at a quarter of a mile a minute. Air pressure at one end and vacuum pumps at the other are required in long tubes.

(Continued to page 162)



Skylight Washer on Aerial Car Cleans High Windows



All windows in factory roof can be reached from an aerial car

Riding high above the assembly lines at the new engine plant of Wright Aeronautical Corporation in Cincinnati, O., window washers scrub the inside surfaces of skylights in the roof without interfering with the workmen below. The 33-acre factory has a saw-toothed roof containing 350,000 square feet of glass. Within each peaked section is a set of tracks on which a car, big enough to hold a man and necessary cleaning material, is operated from one end to the other. To reach the 28 rows of windows, each 1,320 feet long, 56 of these cars are needed.

Polarized Lights on Cars Create New Problems

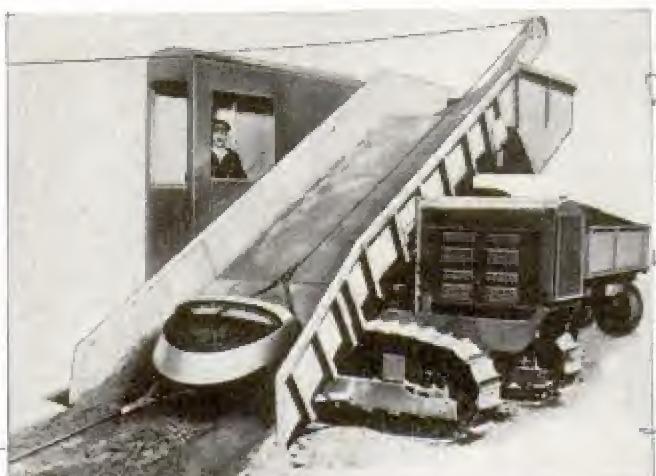
If polarized headlamps are adopted for autos, it is probable they will have to be $2\frac{1}{2}$ to $3\frac{3}{4}$ times brighter than ordinary lights, calling for more battery power, according to tests reported by Val Roper and K. D. Scott, lamp research engineers of General Elec-

tric Company. This is because the polarizing screen in front of the lamp lens stops all light except that vibrating in a particular direction, or about 60 percent of the light. Too, the "analyzer" which would be worn as glasses or attached to the windshield would absorb additional light reflected from objects or pedestrians on the road. During the transitional period, before all drivers were provided with analyzers, the new cars would require two beams, one polarized and the other a less bright depressed beam that could be used when the approaching drivers without analyzers signaled for it.

L10/73

Drag-Bucket Digger Fills Eight Trucks an Hour

In one hour one man operating a combination digger and loader of simple design can load eight five-ton trucks. The shovel is a drag bucket of one cubic yard capacity that digs dirt, clay or gravel, hauling it up a ramp to load it into the truck. A drag line permits operation at 200 feet from the loading unit. All of the movements are controlled by manipulating four levers. Furnished with either an electric, gasoline or Diesel motor, the machine can be moved on crawlers by its own power. Hydraulic rams raise the loading ramp from the ground for shifting the unit to a new position.



Cable hauls drag-bucket up chute to empty contents into truck

L1125.

Rapid "Direct Process" Prints Defense Plans



Fed by hand, this printer develops daily thousands of easy-to-read "positive" copies of defense plans

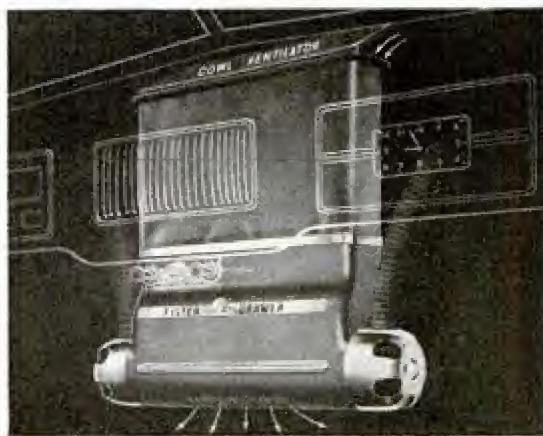
Four operators feeding exposed prints of mechanical drawings into a "direct process" developing machine can turn out 18,000 copies in a 24-hour day at the Westinghouse works in East Pittsburgh, Pa. Applying the developing solution to prints, the 80-inch-wide Goliath produces "positives" with black lines on white paper, instead of white lines on a blue background as in blueprinting. Ordinary transparent drawings, or "tracings," are used as orig-

inals in the printing machine which shines a powerful carbon arc lamp through the tracing onto the coated paper. Where the light strikes the paper, the coating is dissolved by the developing process, but the chemical remains where shadows are cast by the lines of the tracing. The high-speed production of prints is an aid to defense, putting into the hands of machinists, assemblers and others exact plans for the parts on which they are working.

L1180

Heater in Cowl Ventilator Draws Outside Air Into the Car

Fresh, outside air is brought into the car and warmed to the desired temperature by a heater attached to the cowl ventilator of Chevrolet, Ford and Mercury cars. A filter removes dust before the air passes over the heat radiation surface. Fingertip control at the dash permits the driver to regulate the amount of heat delivered. Although the incoming air is barely noticeable, the pressure is strong enough to drive out all foul air and distribute warm air to all parts of the car.

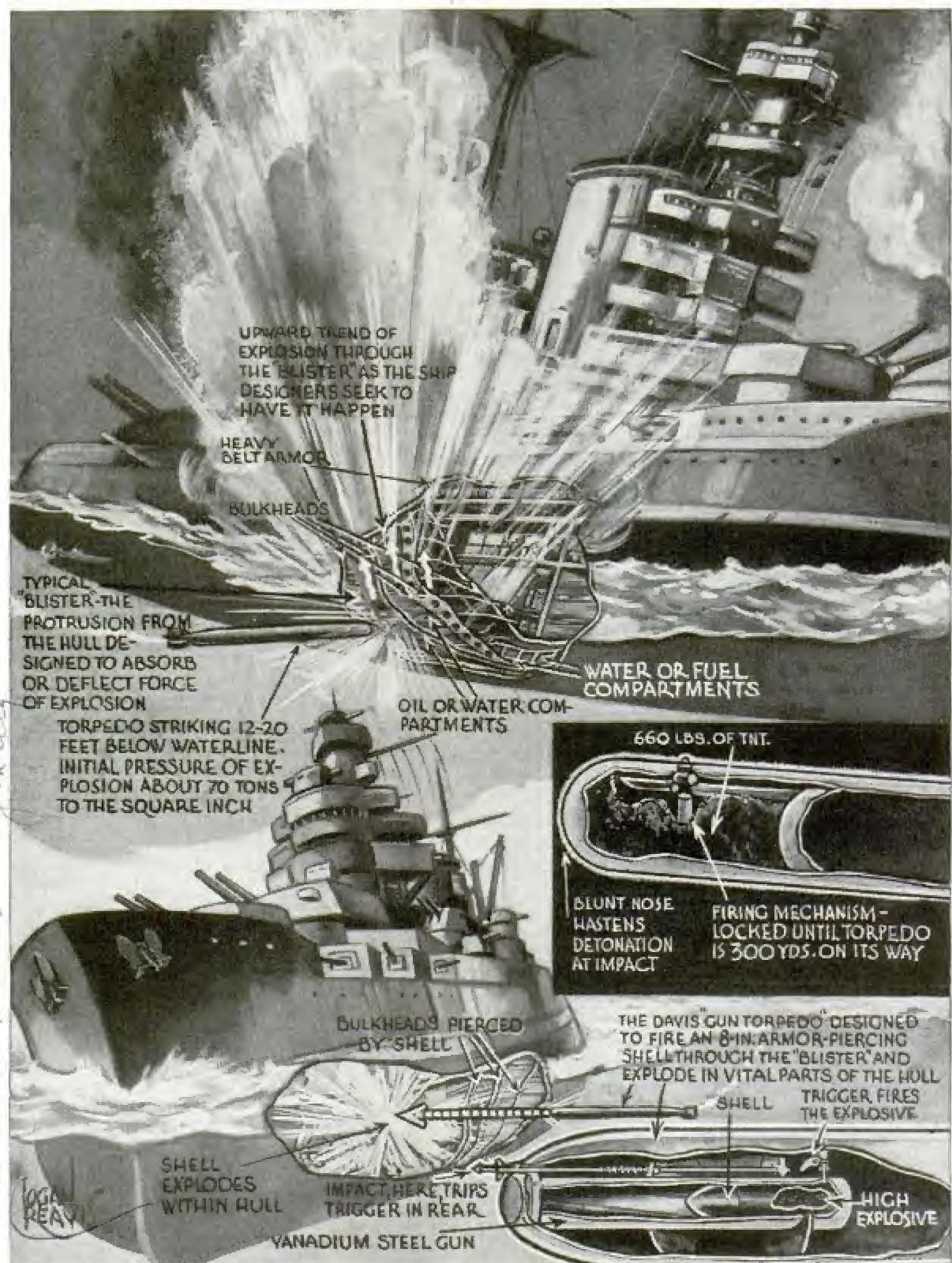


To learn where to buy commercial products described in these pages, see the index.

Cowl ventilator forces air through filter and heater

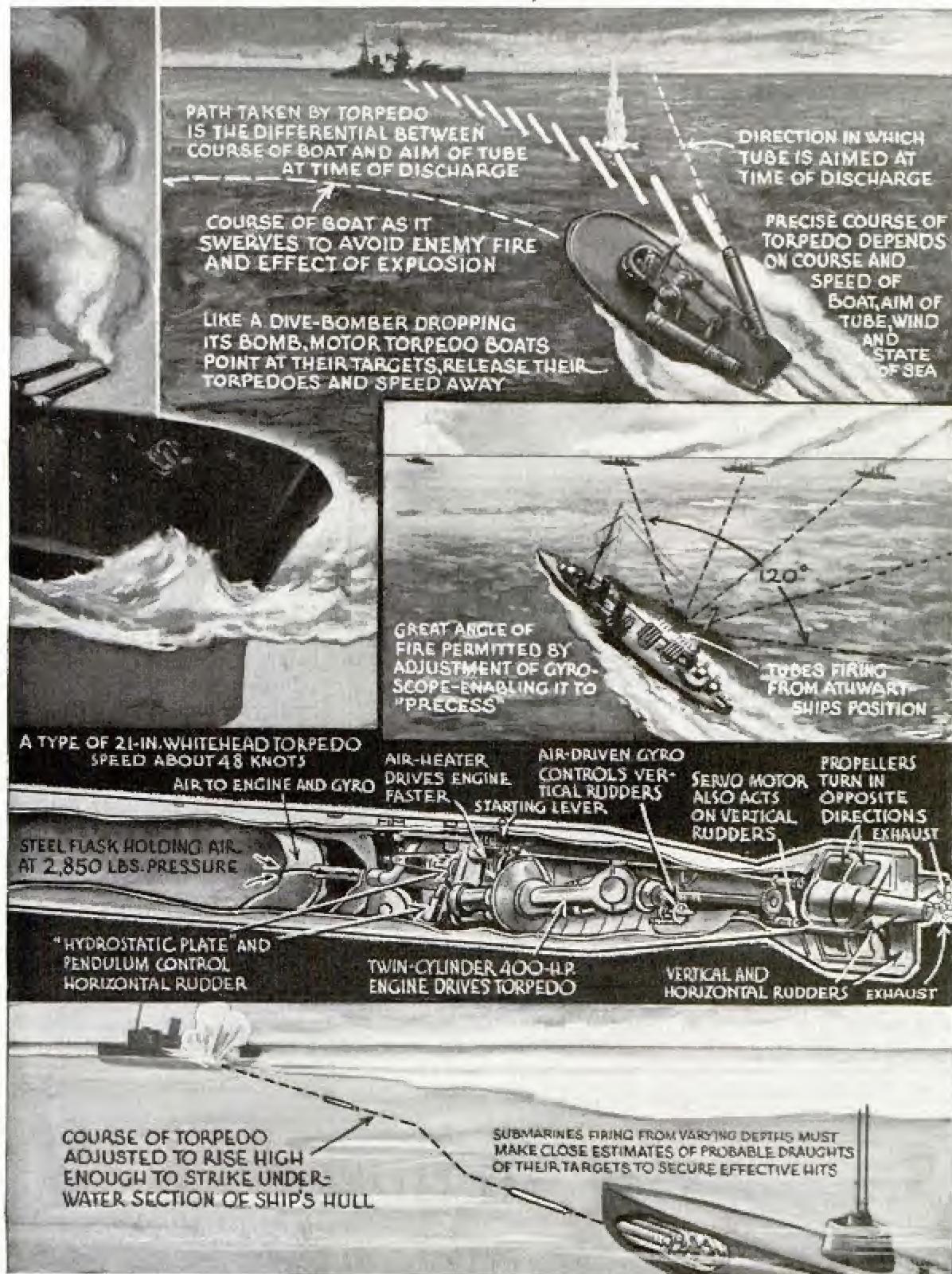
21031

"Gun Torpedo" Fires Eight-Inch Shell Into Hull



War experience indicates no hull design has yet been perfected that is proof against the terrific explosive power of the torpedo. Now comes the Davis "Gun Torpedo," which fires an eight-inch shell through the warship's protective "blister," the shell then exploding against the hull.

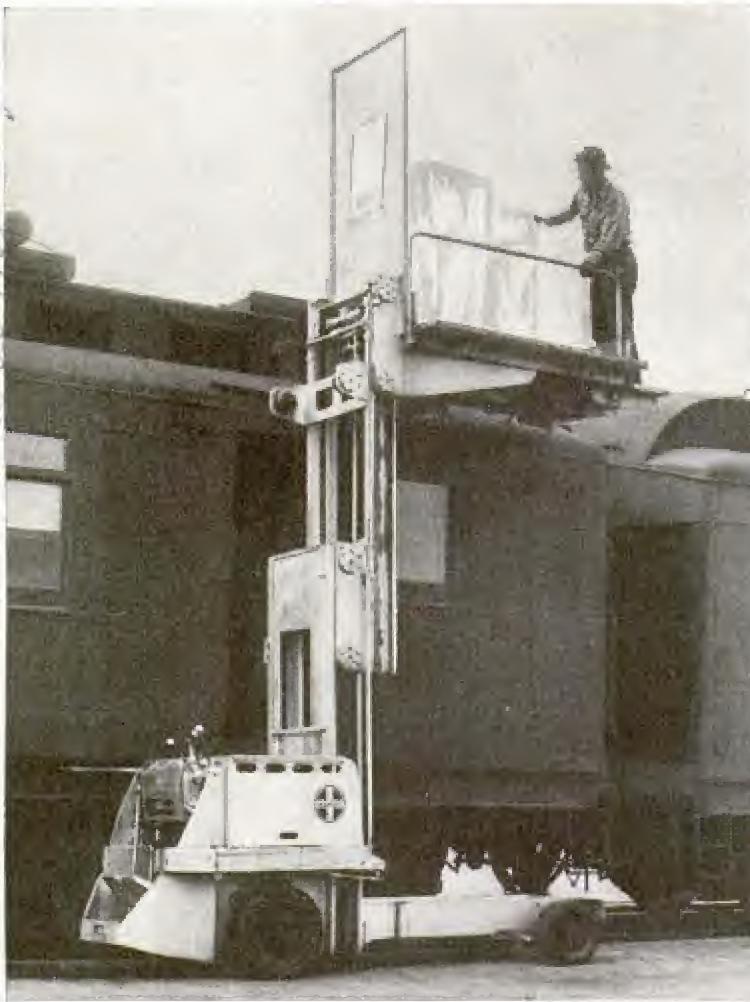
Weapon Strikes Ship's "Blister," Then Explodes



One of the most intricate and precise of weapons, the torpedo costs \$9,000 to \$10,000, can cripple or sink a \$10,000,000 battleship. Since its inception in 1866 it has revolutionized naval and air warfare. The new "Gun Torpedo" is fired by a trigger upon impact with its target.

8/1169.

Telescopic Truck Hoists Ice To the Roof of a Railway Car



The "skyscraper" truck shoulders a ton of ice to roof bunkers of a car

To service its passenger trains with ice in a minimum of time, the Santa Fe railway employs a new high-lift truck that can hoist more than a ton to the level of the car roof in a few seconds. The telescopic truck is operated by storage batteries, with remote control from the loading platform. Formerly the task of filling rooftop ice bunkers required two men, one tossing ten-pound chunks of ice up to the helper.

8/1128.

Spark Plug for U. S. Air Forces Is Kin to Precious Stones

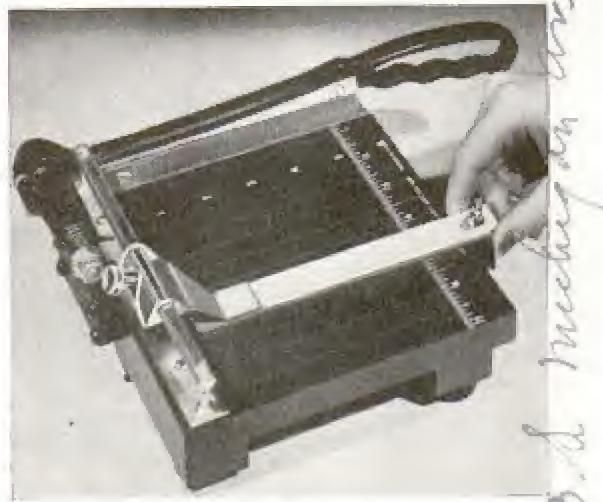
To endure the punishing heat and high compression of aviation engines and withstand the effects of lead in the gasoline, a new spark plug has been developed for the

U. S. Air Forces. Its insulator is chemically akin to sapphires, rubies and oriental amethysts, and is harder than any substance save the diamond. The entire output of the new plug is going to the U. S. government for airplanes and tanks and to commercial airlines for use in transport planes. The basic material of the insulator is aluminum oxide, which is mixed with a binder, molded to shape and then baked in a high-heat kiln.

8/1153

Sliding Cutter Guide Helps Trim Prints To Uniform Size

Especially handy for photographers is a new cutting board with an adjustable metal guide which measures accurately the extent of trimming or cut. A strong spring lock holds the sliding guide firm while cutting. A spring attachment keeps the knife from falling when it is poised in the air, preventing it from injuring the hands or damaging the material.



Movable guide may be set to govern amount of trim

90

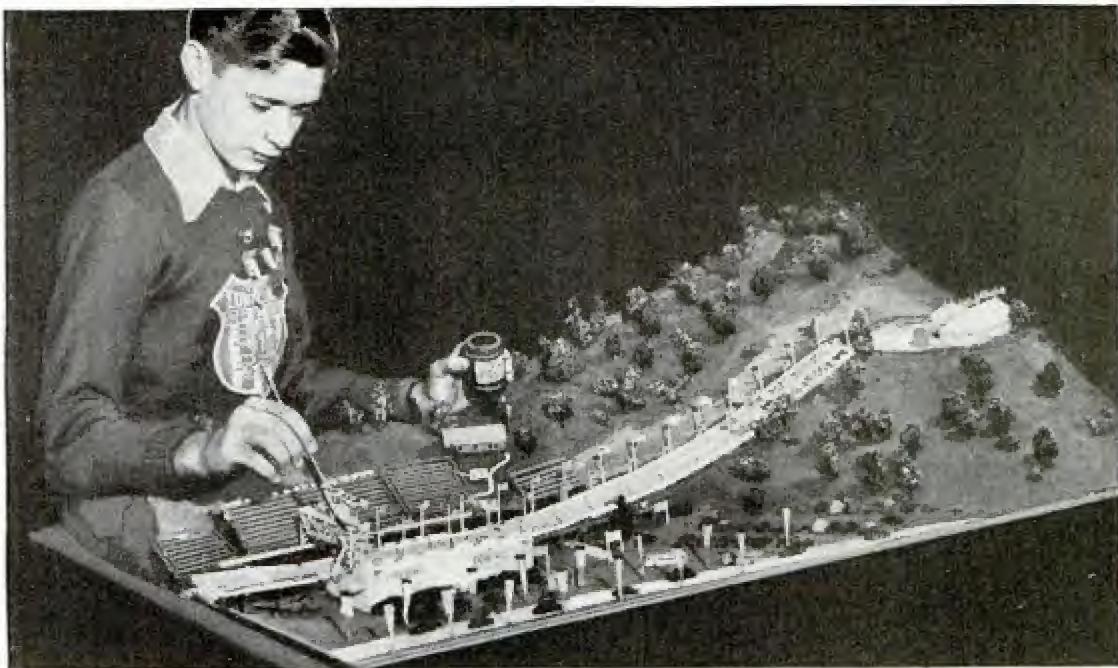
CC Spark Plug
Hir. Syngas motor
Corp. Photo Materials Co
Cars. Filters. Much

POPULAR MECHANICS

McGraw-Hill Publishing Company, Inc., 1940

21119

Young Racer Models Soap Box Derby Track



Fifteen-year-old modeler touching up his miniature replica of Akron course of the Soap Box Derby

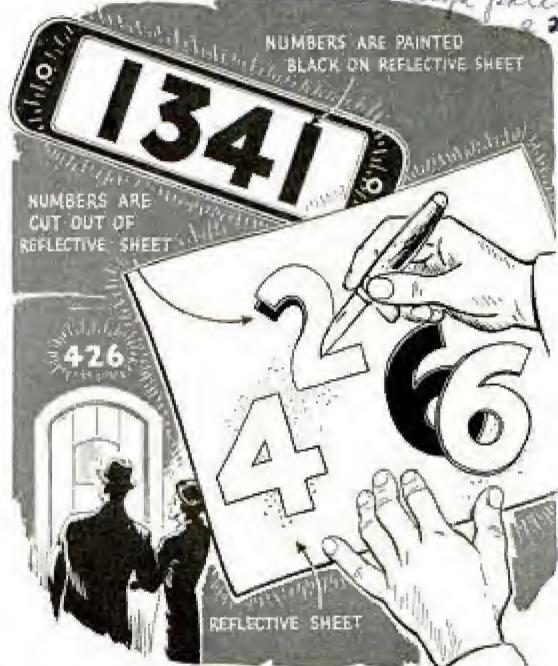
Spending two years at the task, a young Soap Box Derby racer, Jerry Trimble of Terre Haute, Ind., has completed a model of the course at Akron, O., where the national finals are held each summer. Made

of papier mache, cardboard, balsa, toothpicks, matches, paper and sponges, the miniature, which is 26 inches wide and 48 inches long, includes such tiny details as flags, a ticket office and buses pulling in.

Light-Reflecting Letters for Signs Cut From Large Sheet

Signs that reflect light for visibility at night can be made by anyone with a reflective material which resembles oilcloth and comes in rolls 12 and 24 inches wide. The flexible sheet is easily cut with scissors or knife to form any letters or design, and can be stuck to wood or metal. An adhesive on the back is exposed by removing the Cellophane cover, and with a hot iron the material is pressed down, using a sheet of kraft paper to protect the "sparkle" side. This quickly vulcanizes it to metal or wood. The material comes in white, silver and yellow, their brilliant surfaces having a reflective distance of 800 feet for the first two, and 1,500 feet for the yellow finish. A wide variety of uses includes advertising signs, road markers, house numbers, posts, trees or fences.

Write to the firms listed in the Where-to-Buy-It index, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.



Figures may be cut out or painted on sheet as shown

21145
Select-Campbell Laval Co.
General Motors Sales Division

Scotchlite sign panel
e 25 386

91

WANTED: 200,000 MEN



Trainees replace damaged rail on a U. S. Navy patrol boat

Repairing plates on a scow at a Work Experience Center



PLenty of jobs today. But will the employment window slam shut with a sickening bang when the war and the production boom end?

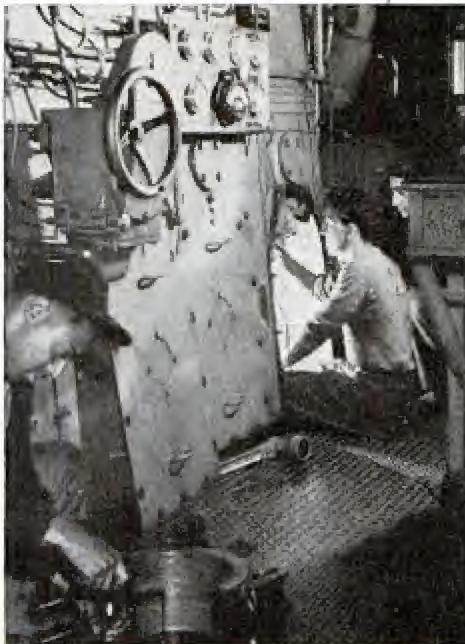
Many a worker would be happier if he knew his job would last a year or more past the next armistice. Well, Uncle Sam has found a spot like that for about 200,000 men—a spot where wartime jobs will not only outlast the war, but will probably last 10 to 20 years after the world settles down to peace.

The job is in one of the many shipyards which dot the coasts of the United States and in the dozens more which are being built or reopened.

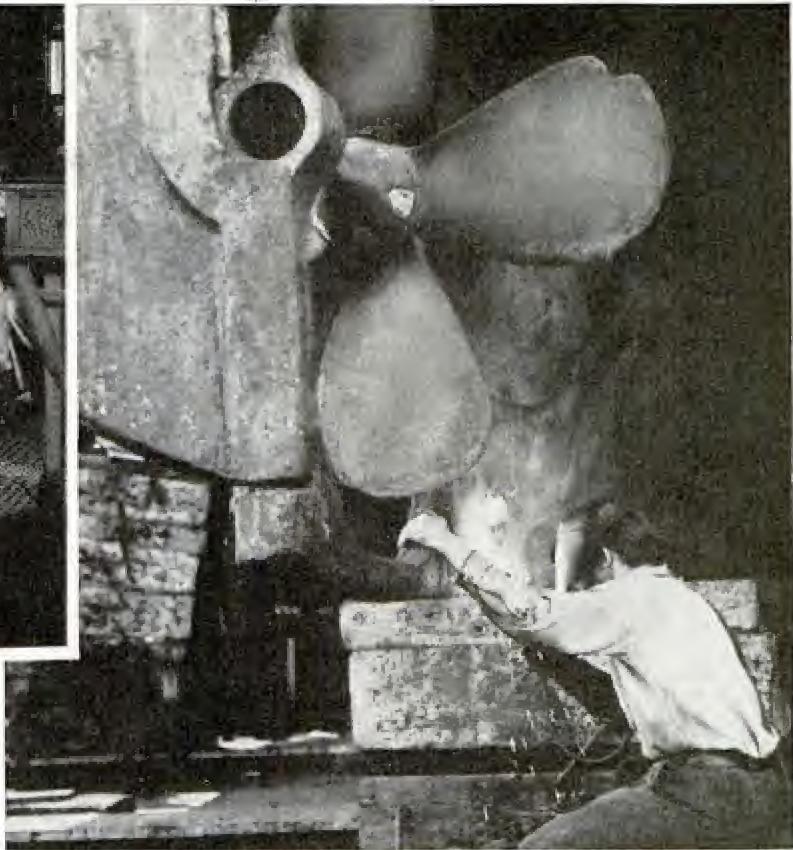
Shipbuilding experts insist that a competent man can go into a shipyard today in his twenties and be fairly certain of still drawing his pay in his forties because of the tremendous tonnage of shipping which has been transferred and sunk. It takes only a few minutes to sink a ship by mine, shell,

Ref: Norman Kuhne.

L826



Overhauling a boat's Diesel engines in N. Y. A. shipyard



While a welder (above) repairs a coast guard cutter in drydock at the Staten Island work center and shipyard, another trainee (below) holds a white hot bar under a giant hammer in blacksmith shop. Several hundred men given experience here have moved to jobs in private industry



bomb, or torpedo, but it takes one to four years to build one.

The average man hesitates to try to land a job in the field because he knows nothing about shipbuilding. Comparatively few of the present generation have had shipyard experience; the Social Security Board combed its files for shipyard workers at the beginning of the defense emergency and could find only 2,400 such men needing employment.

There are two simple ways to get into this rather lush field. One is to get training from any good school which will fit men as expert boilermakers, carpenters, copper-smiths, cranemen, electricians, joiners, machinists, painters, patternmakers, pipe fitters, riveters, sheet metal workers or

2525
welders. A report by the Bureau of Labor Statistics of the Department of Labor indicates that shipyards will be grabbing such trained specialists right up until November, 1942, which gives any young man plenty of time to get the necessary knowledge so that he can go to work in a shipyard and add the specialized experience his job will require.

Uncle Sam himself has figured out the other way to train ship-



Having cleaned the hull and faired the plates of an excursion steamer used for outings of underprivileged New York children, young workers apply fresh paint

The hull of the "Colonel Clayton," right, was chipped and scaled before getting its new paint. N. Y. A. workers gave the steamer a complete overhauling

Below, one of the twin screws of the New York City excursion steamer is being chipped and repainted by one of 900 young men assigned to the Staten Island work center and shipyard for practical experience



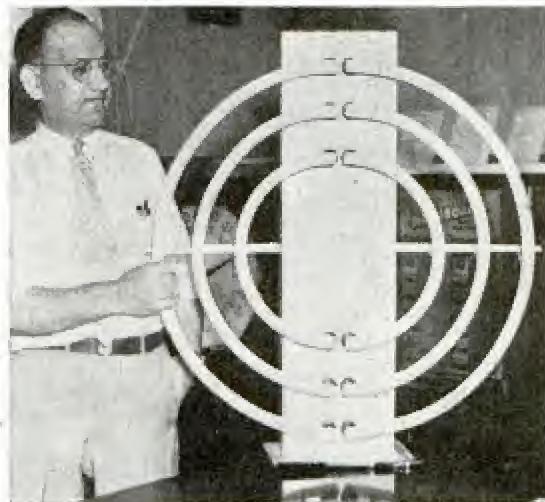
yard workers. While the number thus far turned out is only a drop in a bucket compared with the 10 to 15 thousand new shipyard men needed every month, the plan has proved so successful it is going to be expanded from New York City, where it was tried experimentally, to cities along the Atlantic Coast, the Gulf of Mexico and on the Pacific Coast.

An executive in the National Youth Administration conceived the double-barreled idea—first, of grabbing off an old shipyard on Staten Island, employing veteran shipyard mechanics as foremen and giving thousands of young men the chance to learn shipbuild-

2826

2/17/4

Fluorescent Lamp Is Bent Without Impairing Light



Circles can be formed by bending fluorescent tubes

Fluorescent light tubes now being manufactured may be bent into any shape, even in a complete circle, to meet individual requirements. The fluorescent powder is fused permanently into the tube by a 15,000-volt charge, so it does not crack when the tube is bent or twisted. In addition to its bending properties, the new lamp is said to last 1,000 hours longer than former tubes, it gives two and one-half times as much light, lights immediately without a "warming up" period, and operates in temperatures 20 degrees below zero.

Rubber Pneumatic Door Silencer Stops Rattling and Slamming

Tiny rubber silencers for doors are available to prevent noises of slamming and latch rattle. Hardly noticeable when installed, they are effective for use in homes, hotels, hospitals and public buildings. They are made of live molded rubber and are anchored in holes drilled in the stop-strip of the door frame. The silencer forms a cushion with an air pocket beneath, assuring sufficient tension when the door is closed.



ing by work on ship repair. The second angle was to let the novices get their skill by repairing vessels of the navy, coast guard, maritime commission and the City of New York. This would relieve other shipyards trying to digest Uncle Sam's order for 312 emergency cargo ships and hundreds of other craft.

As a result, the man who conceived the idea, Harold C. Baker, is operating the most unusual shipyard in the world.

While other shipyards are clamoring for men, this one is glad to have a labor turnover and is anxious to get rid of its best workers as soon as possible.

At first, the officials in charge of government vessels needing repairs were hesitant to trust their craft to the yard, but after a few cutters and patrol boats had been overhauled and sent off shipshape by the eager young men and their competent veteran foremen, the skippers of damaged ships began making applications in such number that a long waiting list now exists.

More than 1,000 trainees between the ages of 17 and 24, are now on the job, working under 90 instructors with an average experience of 30 years. Vessels ranging from launches to 250-foot craft, including cutters, patrol boats, scows and tugs are moving in and out of the drydocks at a rate of 16 to 18 a month.

A waiting list exists for trainees, too, because it has gotten around that a physically able and fairly intelligent young man, regardless of his education, can draw \$25 a month and his lunch, plus medical services, while he works six hours a day, five days a week for three months. If he is exceptionally intelligent and willing, or has had some specialized experience, he is likely to be put to work at good pay in a shipyard before his training period elapses. He also receives related classroom training.

A man who has had no special practice at any of the occupations valuable in a shipyard is likely to find himself spending the first few days chipping rust and barnacles off a steel hull with hammer and chisel.

As soon as the novice gets familiar with the shipyard, he usually expresses a desire to become a specialist, such as a welder, or a blacksmith, or a joiner. If he seems apt at the occupation he suggests, he is placed in a position where he can learn by doing.

If he decides to be a chipper or scaler, he is likely to find himself, first with hammer

(Continued to page 174)

Vibrating Reed Takes Pulse Of Industrial Machine



Testing a machine with the meter's vibrating reed

Quick diagnosis of vibration troubles in machinery can be made with a simple meter recently developed. No larger than a foot ruler, it consists primarily of a thin strip of spring steel, called the reed, clamped between two pairs of small steel rollers. In making a test, the meter is held against the "ailing" machine and a knob turned to extend or retract the reed until it is "in tune" with the machine's vibrations. A scale on the back of the meter then shows the frequency of the vibrations, and from this the engineer can usually identify the cause of trouble.

Pan Insert for Steaming Foods Adjusts Self to Fit Any Size

Foods can be steamed in an ordinary cooking pan with the aid of a self-adjust-



Left, steamer in large pan; right, how "petals" fold

ing "bottom" that raises the food above the bottom of the pan so that it cannot burn. The unit is a perforated disk surrounded by a series of overlapping leaves which fold upward like the petals of a flower when they strike the sides of the pan. In this way the steamer "shrinks" when it is placed in a smaller pan. Three legs supporting the disk allow space beneath for the boiling water.

Buoyant Safety Belt Inflates Itself With Gas Stored in Cartridge

For the safety of sportsmen, loggers, bridge workers and others who face the risk of falling into deep water, a self-inflating belt may be worn that will support a 250-pound man in the water for 24 hours. Pressing a section of the belt at left of the buckle fills it with gas immediately, as this



Squeezing belt, top, releases gas from cartridge

forces a pin into the cartridge head and releases the gas which is stored under pressure. If desired the belt may be inflated by blowing through a tube fitted with a valve. A snap arrangement allows the belt to fit neatly around the waist for ordinary wear, but when inflation takes place these snaps give way, permitting the belt to become fully distended.

Look in the index to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.



The CRAFTSMAN

Grille-Door Bookcase

Has Whatnot Shelves at Ends

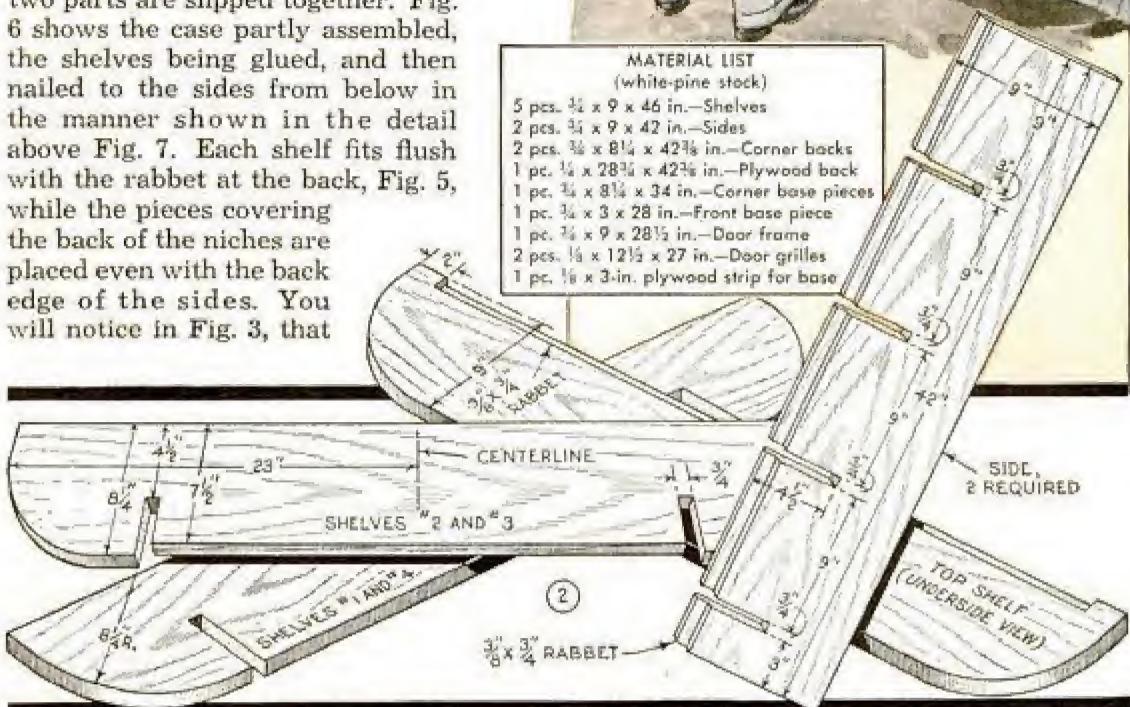
SIMPLICITY of this grille-front book-case, with its flanking niches, Fig. 1, makes it so attractive. Enameled white to contrast with books and pottery, or beautifully finished in walnut, it will harmonize with most furnishings.

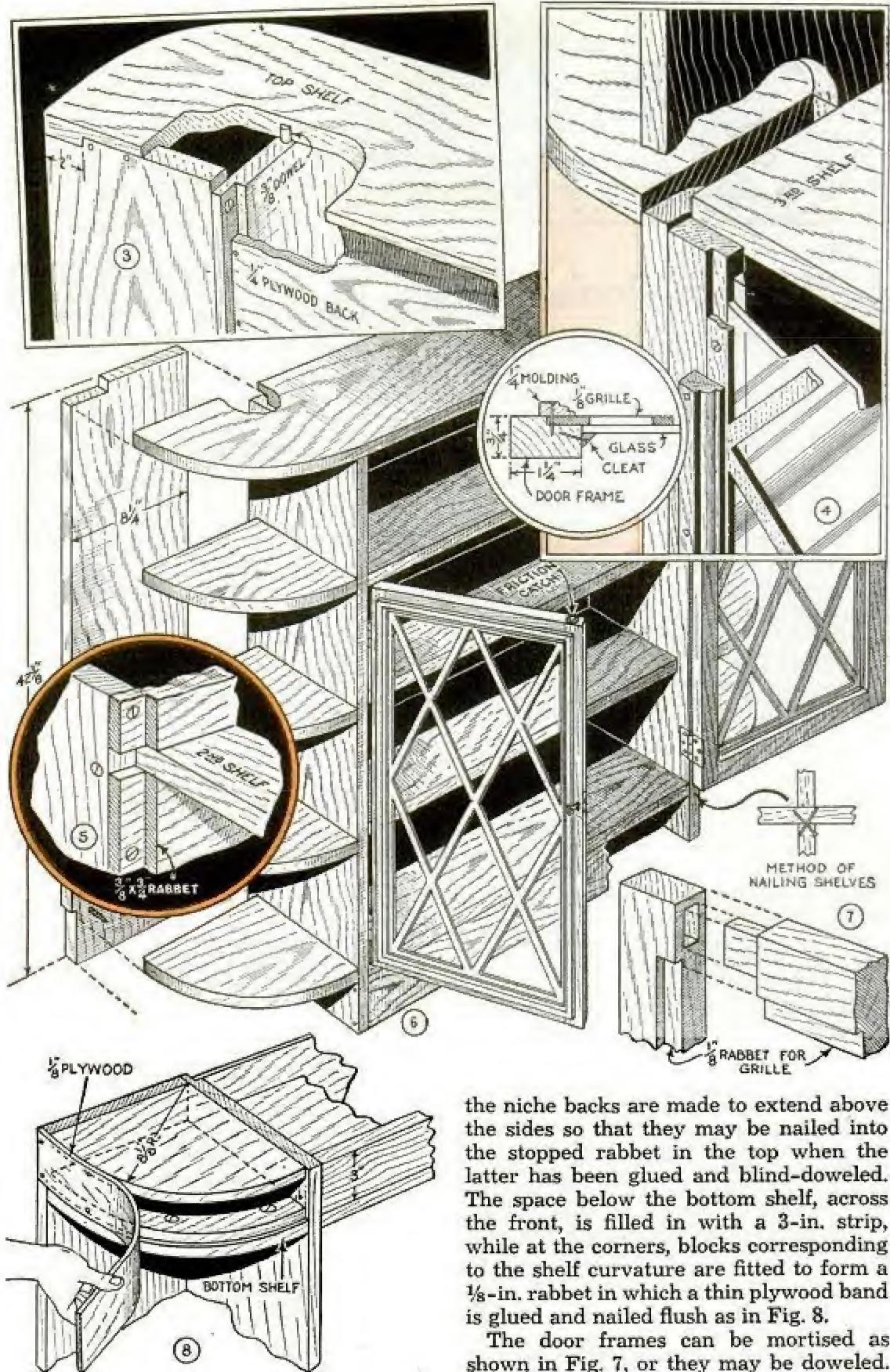
Fig. 2 shows how the main members of the case should look after they are cut. Note that shelves Nos. 2 and 3 are recessed across the front to receive the doors, and that a right and a left-hand side are required. The rabbeted edges can be cut neatly by hand by clamping a guide strip to the work and chiseling carefully to the proper depth. When cutting the half-lap notches be sure that a snug fit will be had when the two parts are slipped together. Fig. 6 shows the case partly assembled, the shelves being glued, and then nailed to the sides from below in the manner shown in the detail above Fig. 7. Each shelf fits flush with the rabbet at the back, Fig. 5, while the pieces covering the back of the niches are placed even with the back edge of the sides. You will notice in Fig. 3, that



MATERIAL LIST
(white-pine stock)

- 5 pcs. $\frac{3}{4}$ x 9 x 46 in.—Shelves
 2 pcs. $\frac{3}{4}$ x 9 x 42 in.—Sides
 2 pcs. $\frac{3}{4}$ x 8 $\frac{1}{4}$ x 42 $\frac{1}{2}$ in.—Corner backs
 1 pc. $\frac{3}{4}$ x 28 $\frac{1}{2}$ x 42 $\frac{1}{2}$ in.—Plywood back
 1 pc. $\frac{3}{4}$ x 8 $\frac{1}{4}$ x 34 in.—Corner base pieces
 1 pc. $\frac{3}{4}$ x 3 x 28 in.—Front base piece
 1 pc. $\frac{3}{4}$ x 9 x 28 $\frac{1}{2}$ in.—Door frame
 2 pcs. $\frac{3}{4}$ x 12 $\frac{1}{2}$ x 27 in.—Door grilles
 1 pc. $\frac{1}{8}$ x 3-in. plywood strip for base





the niche backs are made to extend above the sides so that they may be nailed into the stopped rabbet in the top when the latter has been glued and blind-doweled. The space below the bottom shelf, across the front, is filled in with a 3-in. strip, while at the corners, blocks corresponding to the shelf curvature are fitted to form a $\frac{1}{8}$ -in. rabbet in which a thin plywood band is glued and nailed flush as in Fig. 8.

The door frames can be mortised as shown in Fig. 7, or they may be doweled.

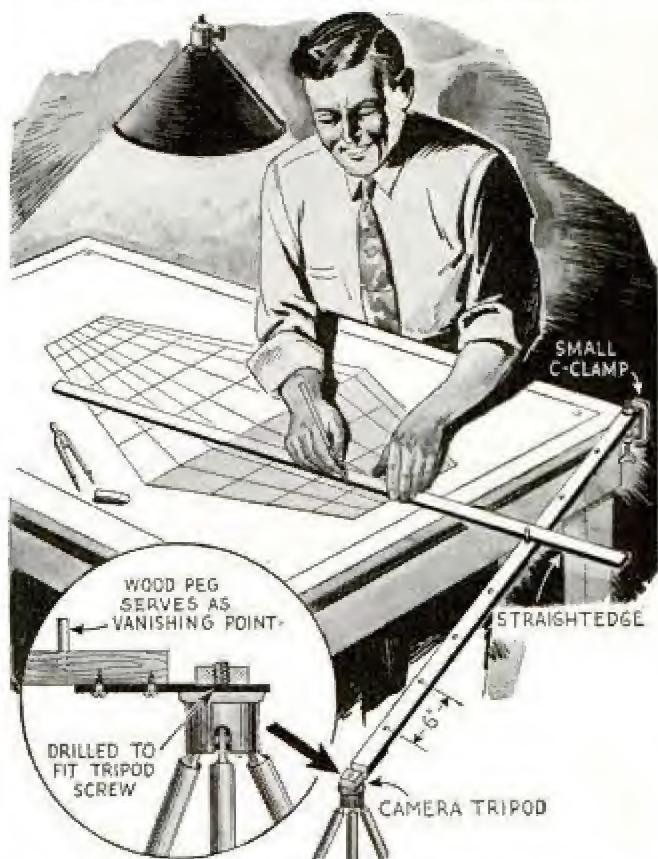
The rabbets need not meet perfectly at the corners as they will be covered later with a mitered molding placed over the screws holding the grille. See Fig. 4. After the grille has been cut from $\frac{1}{8}$ -in. plywood, the edges of the fretwork strips can be sanded to a uniform width of $\frac{1}{2}$ in. with a bevel-edge block to get into the corners. The doors are trimmed and hinged to swing between the two shelves, after which they are fitted with glass, using a small quarter-round molding on the inside to hold it in place. An elbow, and a friction catch can be used to keep the doors closed, while the key of a small mortise-type lock will serve as a handle.

Rugged Bar Clamps Made From Auto Tie Rods

Tie rods having left and right hand threads on the ends can be made into handy bar clamps. Metal plates welded to the ends form the jaws, and two pieces of angle iron welded to the center section provide a shoulder for tightening the clamp with a wrench. Although the jaw spacing of such a clamp is rather limited, its inexpensive construction will permit making up several of them of different widths, by cutting a section from the center and then welding the severed ends together.

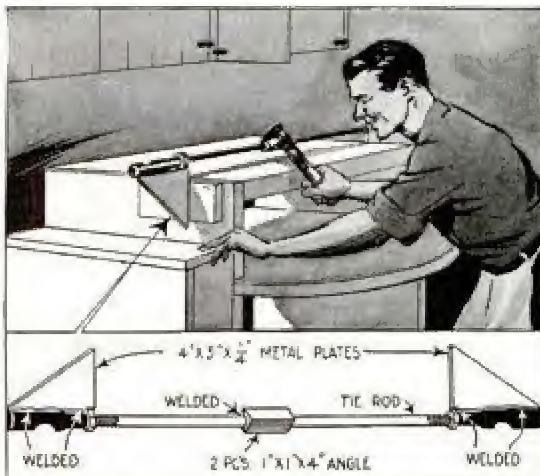
—C. W. Tanner, Cranston, R. I.

Attachment for Vanishing Points Beyond the Edge of Board



The problem of drawing perspectives when the drafting board is not large enough for a long vanishing point, is solved by this simple attachment. It consists of a wood arm having pegs at 6-in. intervals to serve as vanishing points. The arm is fitted at one end with a piece of metal drilled for attachment to the screw of a camera tripod, which supports it. The other end is fastened to the drafting board with a C-clamp.

—Harold M. Haag, Elyria, Ohio.



Nail Aids in Driving Cotter Key

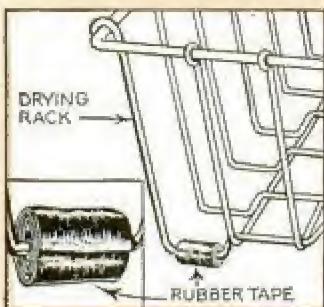
When driving a cotter key in a hole where the fit is snug, you can avoid crushing the eye of the key by using a nail. This is slipped through the eye of the cotter key to reinforce it and prevent it from folding together.



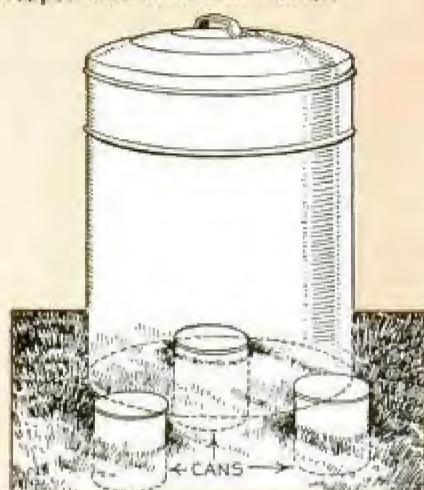
Solving HOME



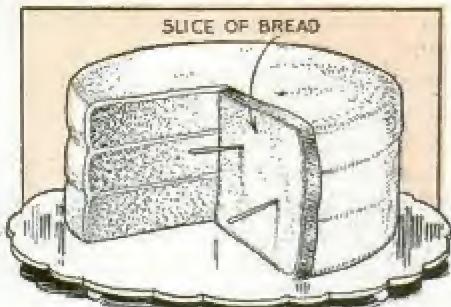
Heat from a register is deflected toward a chair by setting a metal card table over the register as shown



Drying racks for dishes slip less in the kitchen sink if some rubber tape is wrapped around the lower corners



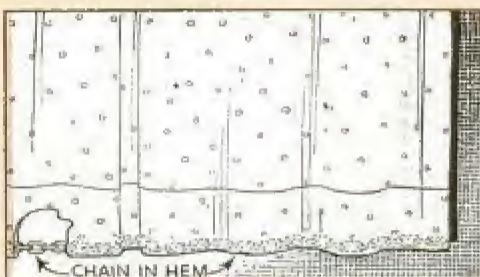
Inverted tin cans are ideal for leveling a garbage can on rolling ground, and elevating it to prevent the bottom from rusting out



Cakes will remain fresh much longer after cutting if slices of bread are pinned to both cut sides with toothpicks



Your wringer stick will always be at hand if a vacuum cup is attached to one end so it can be pressed against the tub when not in use



To prevent curtains from blowing out the window and becoming soiled, insert a small chain in the hem. Paint or lacquer on the chain will keep it from staining the curtain

PROBLEMS



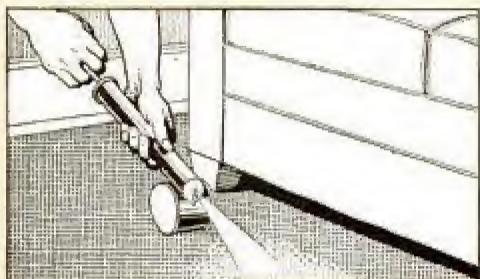
You can exert more pressure on a stubborn jar lid without slipping if a strip of sandpaper is wrapped around it



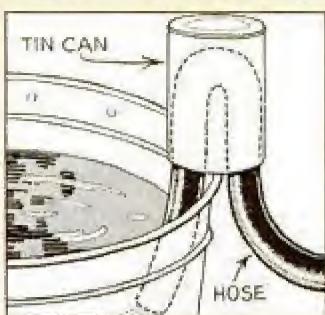
Turned upside down, a chest or dresser drawer makes a handy table at convenient height for typing



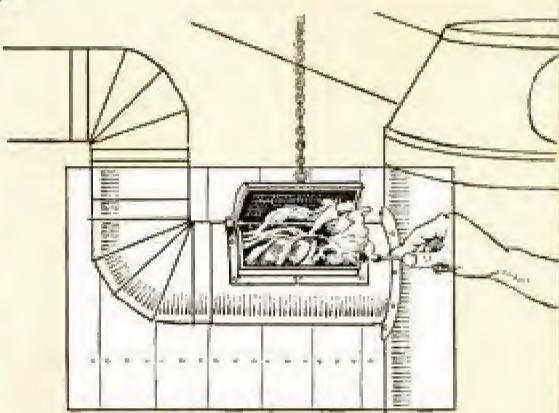
Scratches and worn spots on porch floors caused by rocking chairs can be avoided if you tack felt weather-stripping on the rockers



If the nap has worn off your rug in front of a davenport or chair, making noticeable spots, mix dye the color of the rug, and apply it to the worn spots with an insect sprayer

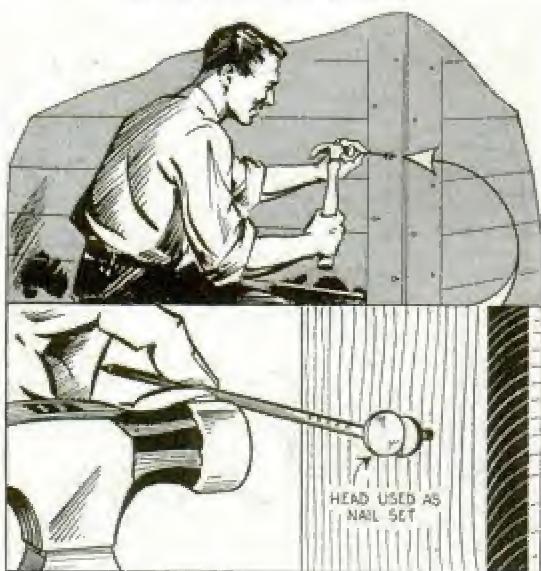


End of filling hose is held on the washbasin by looping the hose and slipping a tin can over it



When occasional furnace fires are started in the spring or fall, and heavy air in the flue causes poor draft, smoking can often be prevented by first stuffing a newspaper in the check draft and igniting it

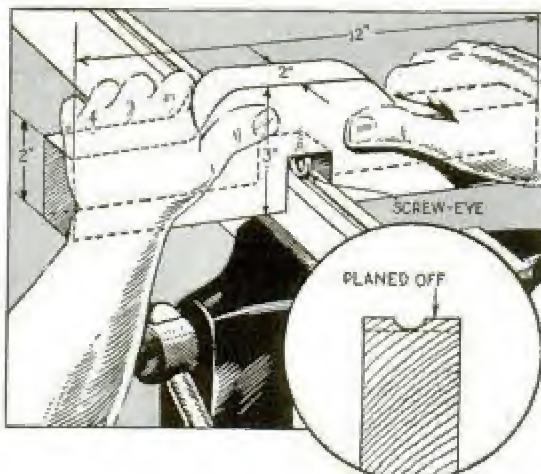
Head of Nail Serves as a Nail Set In an Emergency



The next time you are making a simple repair around the home that requires the use of a nail or two, and you do not have a nail set at hand just use the head of a loose nail as shown. This, of course, is recommended only where the work is not too critical.—Opie Read, Jr., Chicago.

Tool Compresses Edges of Planks To Make Tight Boat Seams

By compressing the wood along the edges of boat planking before screwing it in place, you can get exceptionally tight seams. When the compressed portions of the planks get wet, they swell to resume their original positions and make a tight seam. A good tool for compressing the planks is made from a piece of hardwood



cut to the shape shown and fitted with a screw eye to serve as the compressor. After a groove has been compressed in the plank, the edge is planed down flush with the bottom of the groove.—George W. Neidermair, West New Brighton, N. Y.

Brush Fastened on Paste Jar With Rubber Band

You will never have to hunt for the paste brush if it is slipped under a rubber band snapped around the jar. If necessary, two bands can be used, spacing them an inch or so apart to keep the brush in a vertical position with the end projecting above the jar cover.



RUBBER BAND

Horseshoe Is Practical Handle For Heavy Cans of Oil



When it is necessary to carry a heavy oil can about the farm, slip one side of a discarded horseshoe through the wire finger loop usually provided on such cans. The horseshoe will give you a comfortable handle for carrying the can, also one that is easily removed when not in use.

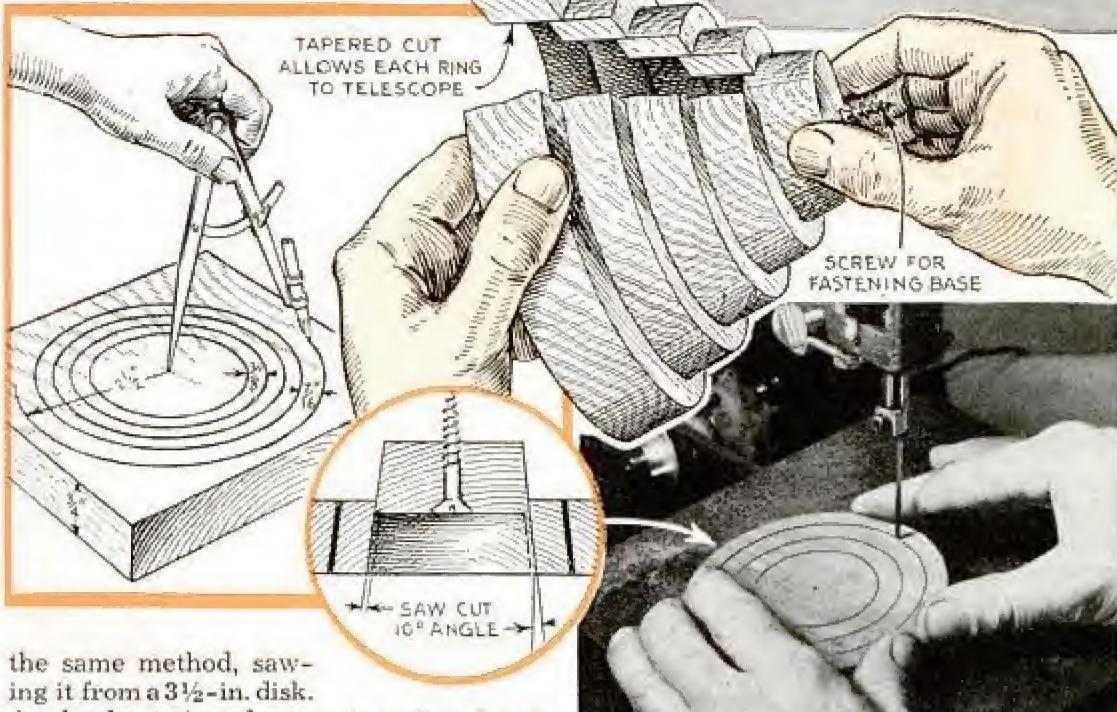
Simple Way to Hold Garden Hose While Filling Pail

Here is an unusually simple way to hold the end of a hose in a pail while filling it. Just insert the hose end through and around the bail while it is held in vertical position, ending with the end of the hose pointing downward into the bucket.



AT A glance this candy bowl appears to have been turned from a built-up block of several pieces. However, it consists of several concentric rings and a small disk scroll-sawed from two pieces of $\frac{3}{4}$ -in. wood, the rings being pulled out to form the cone-shaped body and the inverted cone-shaped base. The circular detail shows clearly how the taper compensates for the saw cut. If you use a fine blade and are careful in sawing to line, the edges of the rings will fit perfectly, requiring little sanding before finishing with filler, shellac and varnish. The first thing you do is to draw five concentric circles for the bowl part, making the outer one a little wider for the rim as indicated. After this, a tiny hole is drilled straddling each line for inserting the saw blade. The sawing is done with the table tilted 10 degrees.

For the two-ring base you follow



the same method, sawing it from a $3\frac{1}{2}$ -in. disk.

Apply glue to just the very top edge of each ring to avoid getting glue on the exposed end grain which would spoil the finish.

You do not have to stick to plain circular shapes—you can add variety by cutting the rings triangular, square or oval shape, and by varying the cuts from straight lines to scallops. Lamp bases, urns for artificial flowers, fruit dishes, etc., are a few of the many articles that can be made by this economical method of construction.

—Benjamin Nielsen, Aurora, Nebr.

Telescoping CANDY BOWL



Save That Broken Nail Set

Don't throw away that broken nail set just because the cup point may be broken off. It can be made practically as good as new simply by regrinding it to its original size, and then cutting a nonslip surface on the flat end of the point by standing it on a mill file and striking a sharp blow, after which it is turned 90 degrees and struck again.—James H. Gosch, Scotia, N. Y.

Dog Won't Tear Off Bandage If It Is Soaped



If your dog has a bandaged leg or foot and tears off the bandage with his teeth, wet a cake of soap and rub it over the bandage as indicated. A dog does not like the taste of soap and therefore will not bother the bandage.

—William Swallow, Brooklyn, N. Y.

Toy Steam Engine Is "Fired" By Cigar Lighter

Instead of heating a toy steam engine with the usual alcohol lamp, which needs constant attention, remove the lamp and



install a cigar lighter. In making the installation, take care to insulate the lighter and wires from the metal parts of the engine so that there will be no possibility of a short circuit.

—Geo. Kilpatrick, Jr., Drexel Hill, Pa.

Repair for Porcelain Tanks

A porcelain flush tank that has been cracked can be repaired temporarily until it can be replaced with a new one, by using resin glue. First, be sure to dry the tank thoroughly inside and out. Then apply the glue to the crack with a brush and rub it into the fracture thoroughly with the fingers. Wipe off the excess glue and let the repair dry for 24 hours before allowing water to run into the tank.—Hi Sibley, Pasadena, Calif.



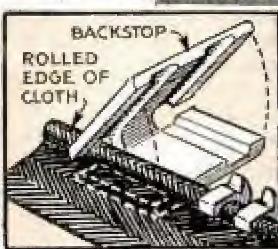
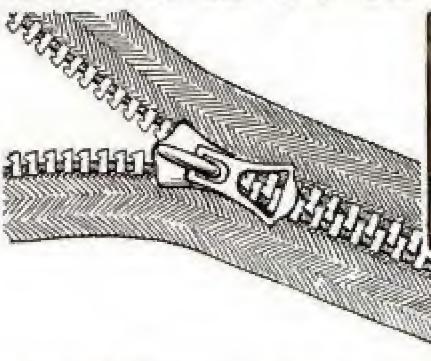
Penny Bank From Rubber Ball

You will be surprised what a dandy little penny bank you can make from a hollow rubber ball. Just cut a slit in it to take a coin snugly. Any possibility of a child removing the coins from the ball is very remote because it is a difficult job. The natural tendency of a child would be to squeeze the ball in order to widen the slot, but this tends to shorten the length of the slot and the coins will not come out.



One simple way to separate tough clumps of peonies is to drive two garden forks, back to back, into the center of the clump and then push the handles in opposite directions. If this is done carefully it will split the clumps apart without destroying the eyes.

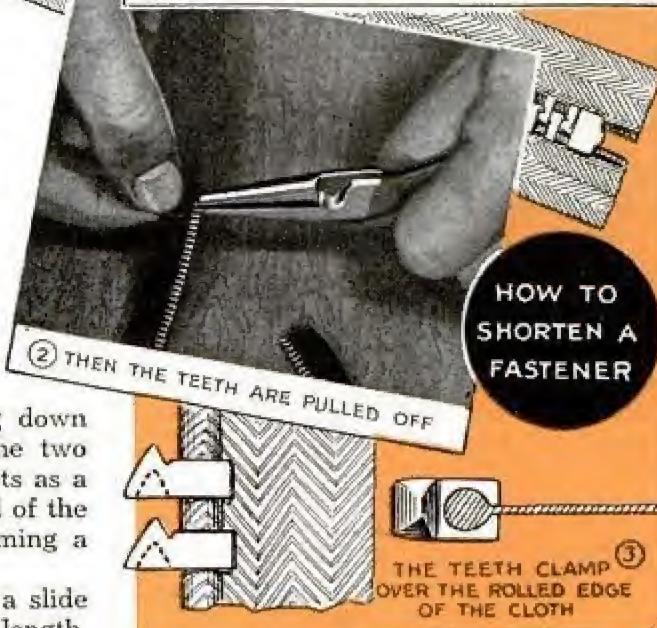
How to Alter and Repair SLIDE FASTENERS



① THE BACKSTOP IS OPENED AND REMOVED

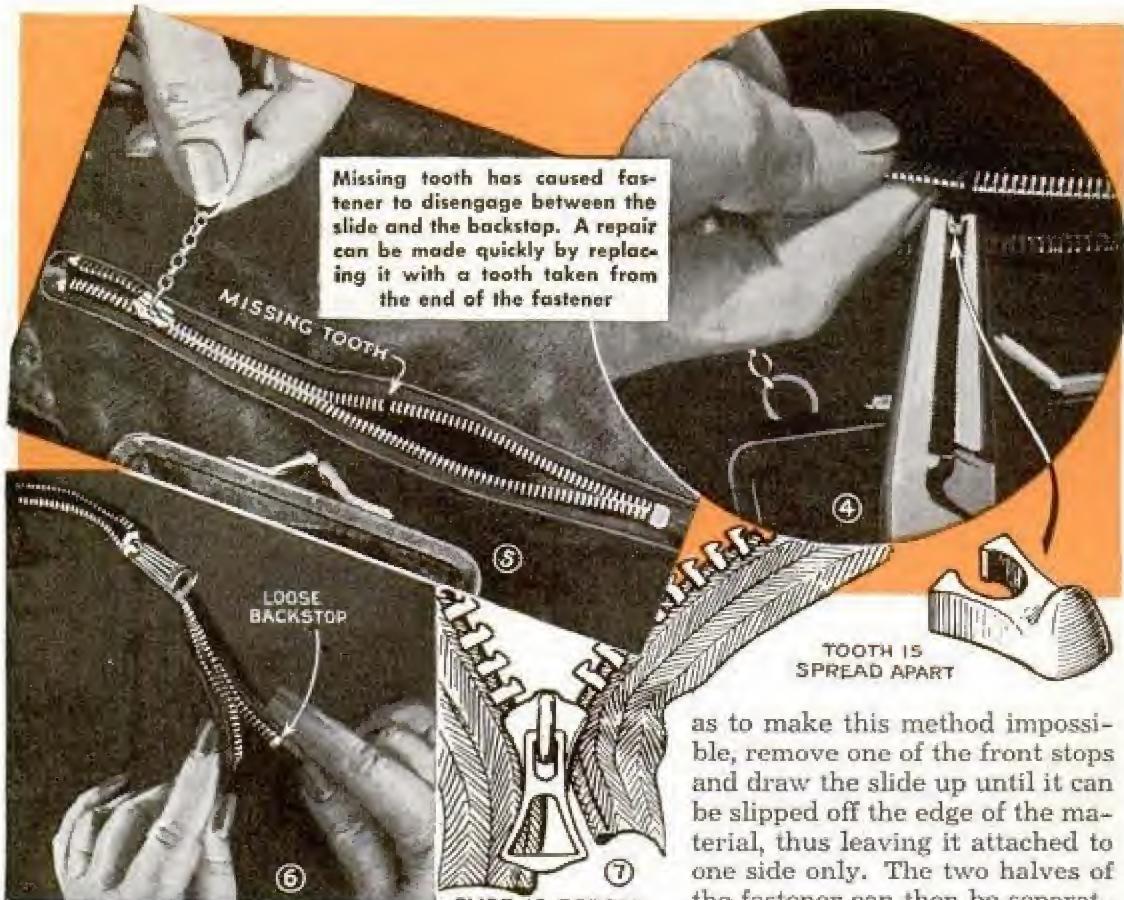
A SLIDE fastener that does not work properly can be repaired by anyone, once its construction is understood. First, examine the fastener carefully. You will notice that it consists of two strips of fabric to which are attached the metal parts. The teeth, which are fitted to engage each other when brought together, are clamped to the edge of the fabric, Fig. 3. At the bottom of the fastener is a metal clasp that bridges the two strips of fabric, clamping down over both rolled edges to hold the two halves together. This clasp also acts as a stop for the slide. At the other end of the fastener are two metal clasps forming a stop for the slide.

When it is necessary to shorten a slide fastener, first mark off the desired length. Then make a second mark about 1 in. below the first to allow some extra material. Next, remove the backstop, Fig. 1, by prying it open. The next step is to cut away the rear part of the fastener up to the second mark, and remove all the teeth from the rear of the remaining part up to the first mark, Fig. 2. To remove a tooth, it is only necessary to grip the end with a pair of long-nosed pliers and pull it away from the material. Grip the part of the tooth which projects past the edge of the material, as in Fig. 4. The fastener can be re-assembled by slipping the two ends into the slide, Fig. 7, and drawing this up until the teeth are properly engaged. The backstop is now replaced and clamped down over the two edges of the material with long-nosed pliers.



Knowing how to do this much, it is a simple matter to repair a fastener that has become damaged. One of the most common troubles is where the closed portion of the fastener has opened up due to a missing tooth, Fig. 5. In this case, it is necessary to replace the missing tooth by removing one from the end and clamping it in place. After removing the tooth, the forked opening is spread so that it can be slipped over the rolled edge of the fabric, Fig. 4. In most cases, the fastener can be closed by grasping the slide firmly and drawing it back sharply until it hits the open part. This will close several of the teeth, and if repeated several times, will eventually close all the teeth.

Should the accessory be of such a design



Loose backstop caused this fastener to open at rear. Repeatedly moving the slide against it will usually close it

as to make this method impossible, remove one of the front stops and draw the slide up until it can be slipped off the edge of the material, thus leaving it attached to one side only. The two halves of the fastener can then be separated by drawing them open from behind, and the slide can be moved to the rear where it can be hooked back onto the material.

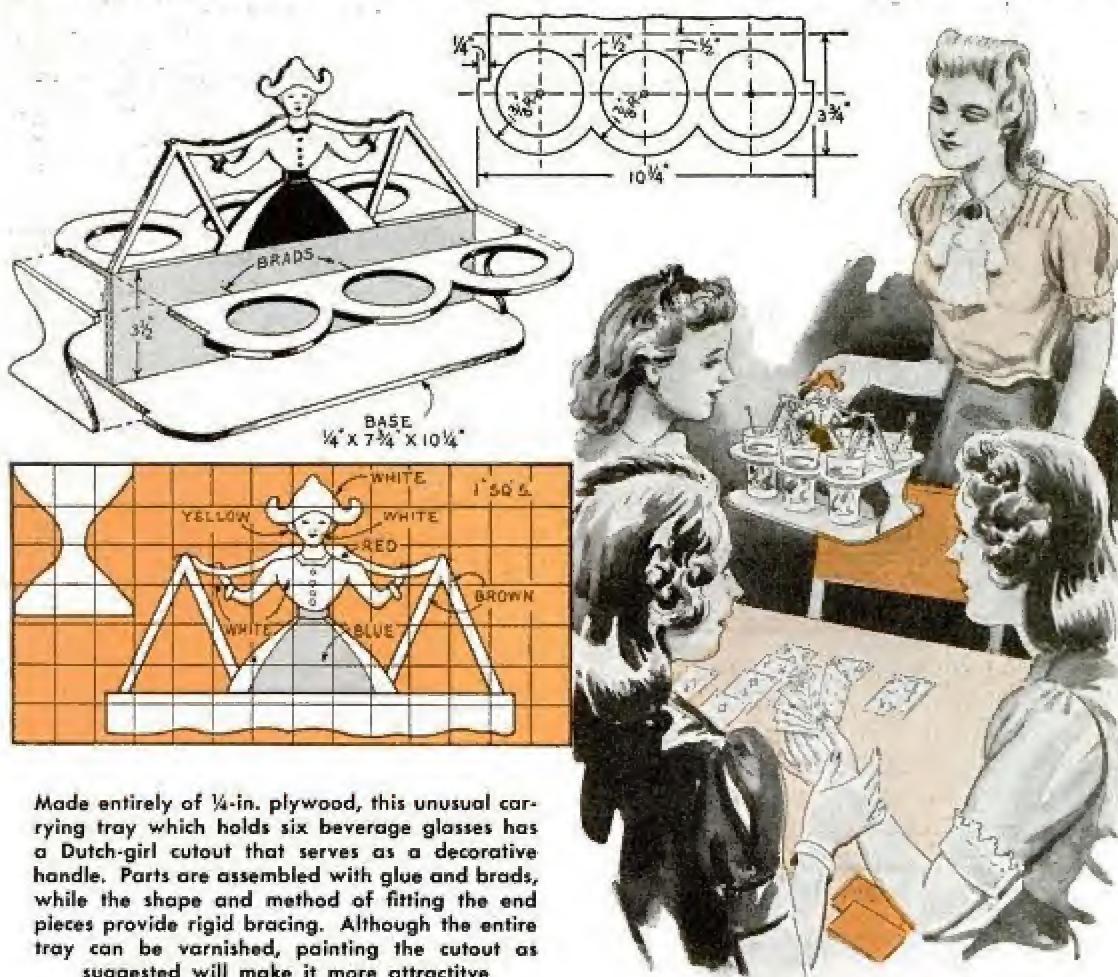
If the lining of a garment gets caught in the fastener, remove the front stop and the backstop, spread the fastener apart, remove the lining, and then reassemble. This is much better than attempting to force the slide back over the tangled area to free the lining. Fig. 6 shows a fastener that has become opened in the rear due to a loose backstop. To repair this the backstop should be removed and the fastener closed by drawing the slide back sharply several times.

In Fig. 8, a sport jacket has been improperly closed. Fig. 9 shows the result. The fastener has become opened at the rear. The backstop in this case is a combination of two parts which must be fitted together before the fastener can be closed. If a slide moves freely back and forth without fastening the two halves, it has become spread. Remove the backstop and the slide, and with a pair of pliers, bend the slide back into its original position.

The fastener shown on the sport jacket above has been improperly closed. The combination backstop has not been fitted together before closing the fastener with the result that it has been opened at the rear end as shown in the photo at the right



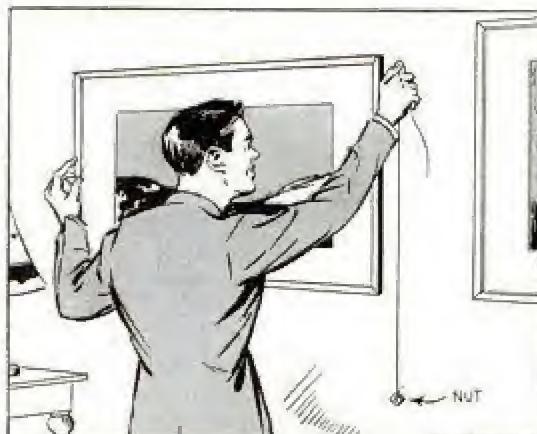
This Dutch-Girl Tray Holds Six Beverage Glasses



Pictures Are Hung Straight With Improvised Plumb Bob

It's a simple matter to straighten large pictures on a wall when an improvised plumb bob of the type shown is used to line up the edges. All you need to make one is a nut and a piece of string slightly

longer than the height of the largest picture. In use, just grasp the string near the upper end with the right hand and hold it against the wall near one side of the picture frame, which leaves the left hand free to adjust the picture until the edge is parallel to the string.

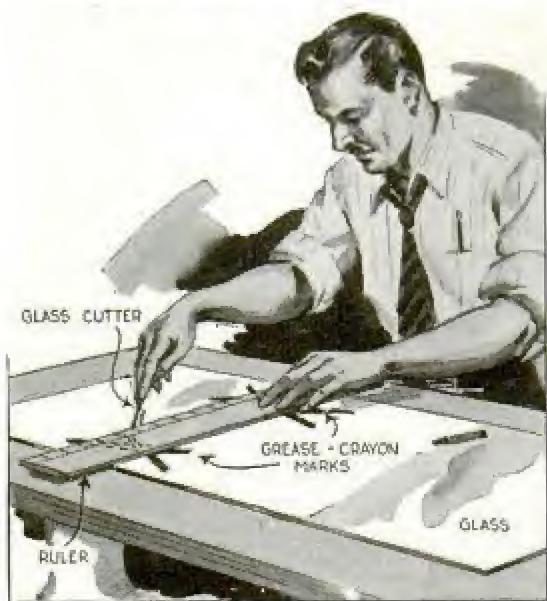


Rustproofing Metal Fixtures

Mix a good grade of clear synthetic resin with lamp black or any colored pigment and apply two heavy coats to all metal that is exposed to the weather to insure longer rust-free life. For electrical fixtures that might oxidize and discolor outside paint or stucco, use the same clear synthetic resin without any coloring added. Two coats will be sufficient.

—Dana Anderson, Topeka, Kans.

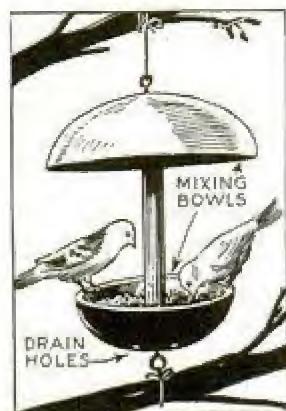
Crayon Marks Help to Hold Rule While Cutting Glass



To help keep a rule or straightedge from slipping while using it as a guide for a glass cutter, make heavy marks on the glass with a wax crayon. This will afford sufficient friction to hold the rule in place.

—G. E. Hendrickson, Argyle, Wis.

Bird Feeder From Mixing Bowls



bowls are attached to the ends of the dowel with screweyes as shown. The feeder can be suspended between two tree branches.

Tinting and Matching Paint

While mixing your own paint colors, don't tint the entire amount needed at once, but stir color into part of your white to avoid overtinting. After the desired shade is attained, tint balance to conform, then

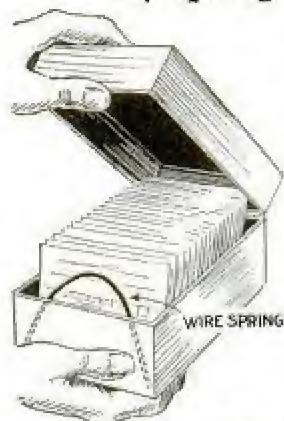
mix together. If you have underestimated the amount needed, do not use all the tinted paint before trying to match it. The best way to match is to retain in a bucket a small amount of tinted paint, then take your additional white and gradually apply tinting color, repeatedly comparing the two buckets of paint by dipping stirring paddle from the new batch into the first mix so that both mixes appear on paddle. If there is danger of running short of paint, break off clean at a corner. Any slight shading variation then cannot be detected.

Chuck Thin Metal Washers For Turning in a Lathe

The next time you have some very thin metal washers or disks to machine, here is an easy way to chuck them in a lathe. Just solder each one to the end of a piece of rod or shafting and then chuck this in the lathe. The solder is melted to remove the work from the shaft. Fiber or plastic may be handled in a similar manner by gluing it to the end of a hardwood rod.



Cards Are Held Vertical in File By Spring-Wire Stop



If cards kept in a hinged-box file have a tendency to fall forward and interfere with closing the cover, a spring-wire stop will prevent this trouble. The wire is bent to the shape shown and inserted in the front of the box.

When cleaning "washable" wall papers, make heavy suds, using warm water and a mild soap, and apply it with a clean cloth. Do not let suds remain on paper too long.

Decorative Lamps From Two Simple Turnings

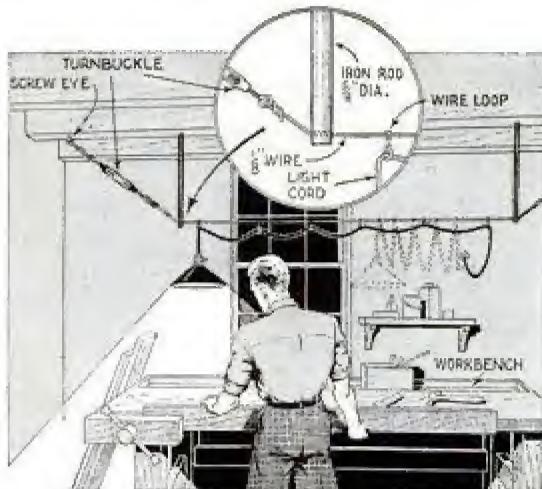


Used in pairs, these lamps are neat on a dressing table, and they can be turned from wood to match the room furnishings. Each one consists of a disk standard and base, the hexagonal one being shaped by sawing or sanding the flat surfaces on the disks.

After turning the standards, they are bored out in the center and then are drilled from edge to edge for a lamp cord and nipples on which to screw lamp sockets. When the cords have been installed in the base and standard, the two are assembled with dowels, and turned rosettes are glued over the openings in the standards. Wood of a contrasting color is used for making the rosettes.

—Dale Van Horn, Lincoln, Nebr.

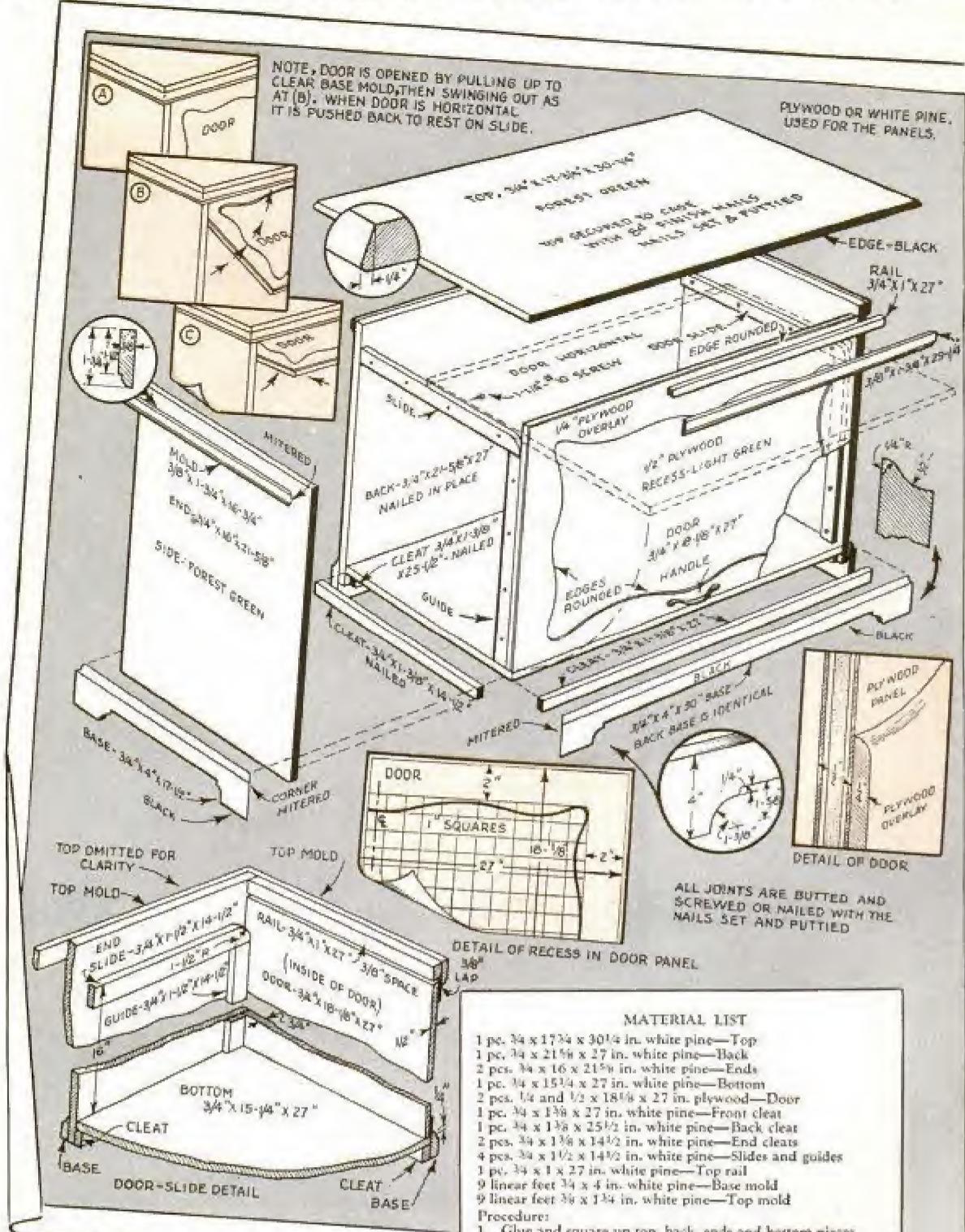
Adjustable Light Over Workbench Slides on Taut Wire



It takes only a second to move this adjustable light over any section of the workbench as it slides on a taut wire fastened to a joist. Two $\frac{5}{8}$ -in. rods hold the wire at a convenient height, and a turnbuckle connected near one end provides a means of tightening it. Several wire loops or rings spaced along the lamp cord prevent it from sagging.

The greenish corrosion usually found on storage battery terminals provides an effective flux for soldering cast iron. The iron must first be scraped to a shiny brightness and then coated with the corrosion, which provides a copper base to which the solder will adhere.

Wood CHEST *and* BELLows



MATERIAL LIST

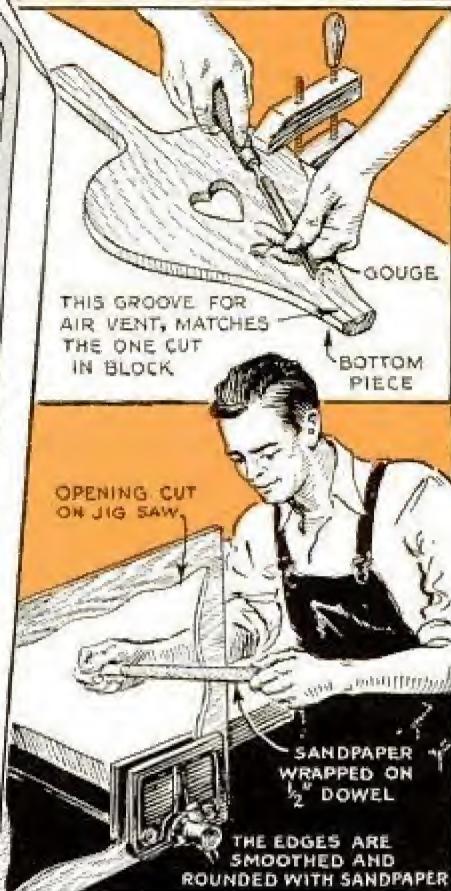
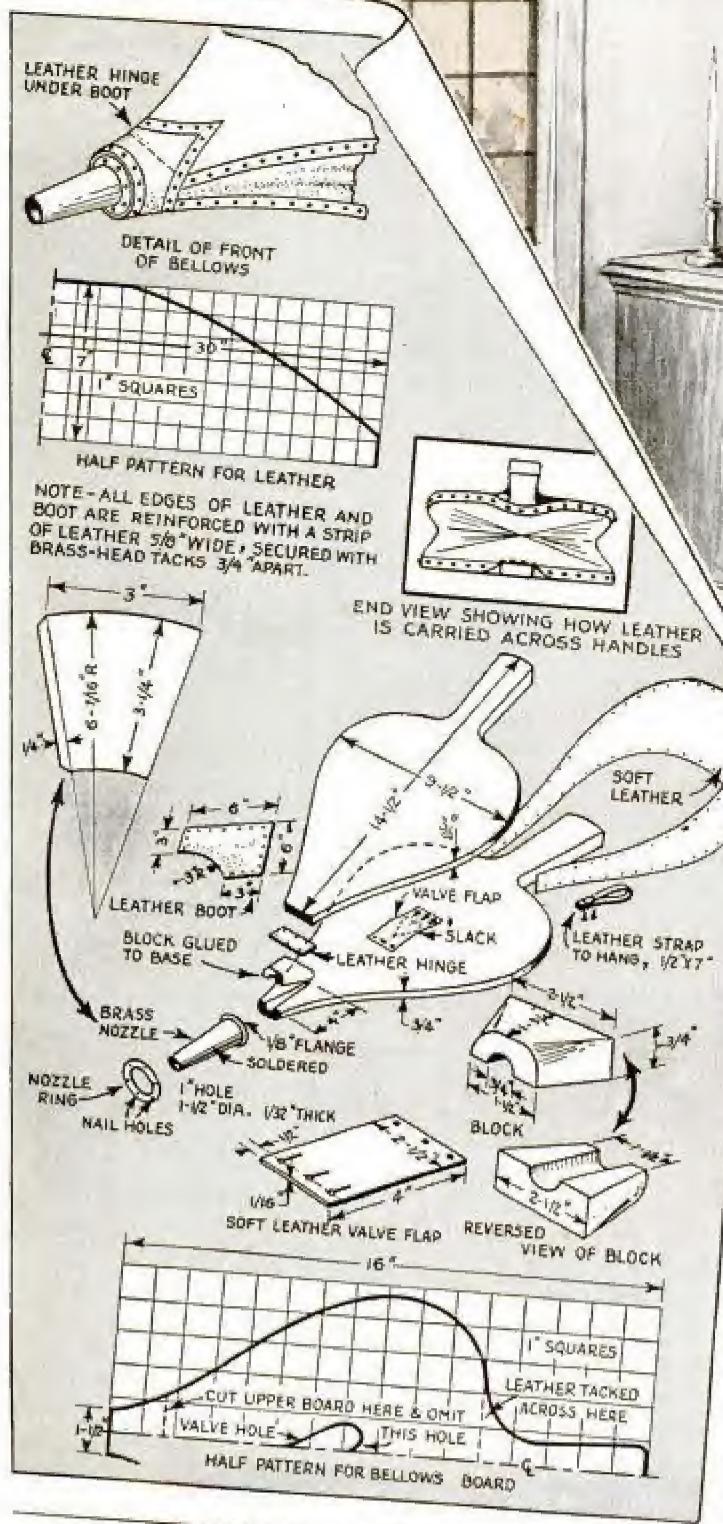
- 1 pc. $\frac{3}{4} \times 17\frac{3}{4} \times 30\frac{1}{4}$ in. white pine—Top
 1 pc. $\frac{3}{4} \times 21\frac{1}{2} \times 27$ in. white pine—Back
 2 pcs. $\frac{3}{4} \times 16 \times 21\frac{1}{8}$ in. white pine—Ends
 1 pc. $\frac{3}{4} \times 15\frac{1}{4} \times 27$ in. white pine—Bottom
 2 pcs. $\frac{1}{4}$ and $\frac{1}{2} \times 18\frac{1}{8} \times 27$ in. plywood—Door
 1 pc. $\frac{3}{4} \times 19\frac{1}{8} \times 27$ in. white pine—Front cleat
 1 pc. $\frac{3}{4} \times 13\frac{1}{8} \times 25\frac{1}{2}$ in. white pine—Back cleat
 2 pcs. $\frac{3}{4} \times 1\frac{1}{8} \times 14\frac{1}{2}$ in. white pine—End cleats
 4 pcs. $\frac{3}{4} \times 1\frac{1}{2} \times 14\frac{1}{2}$ in. white pine—Slides and guides
 1 pt. $\frac{3}{4} \times 1 \times 27$ in. white pine—Top rail
 9 linear feet $\frac{3}{4} \times 4$ in. white pine—Base mold
 9 linear feet $\frac{3}{4} \times 1\frac{1}{4}$ in. white pine—Top mold

Procedure

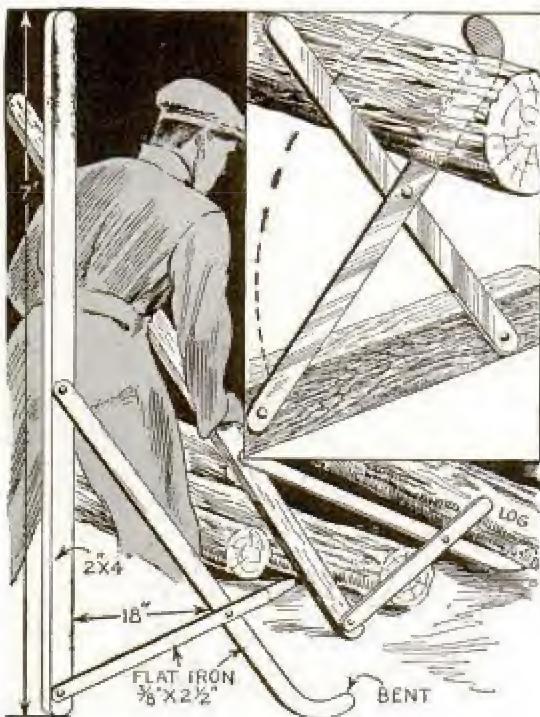
- Procedure:**

 1. Glue and square up top, back, ends and bottom pieces
 2. Locate, nail and glue cleats, guides and slides in place
 3. Assemble carcasse and apply molding, mitering corners
 4. Enlarge and trace door scroll. Saw opening and sand edges
 5. Glue up two part door and fit in opening
 6. Punty nail holes, sand and apply undercoat and enamel

for Your Fireplace



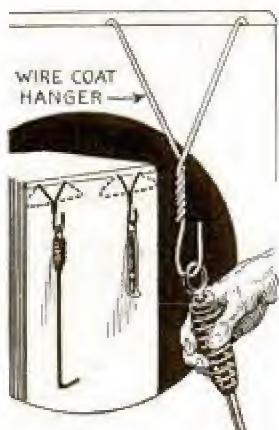
Work Lifted Easily on Sawhorse By Prying Action



With the type of sawhorse shown, you can insert it underneath a log or other work and raise it into position for sawing. The horse consists of a couple of pieces of flat iron bent to the shapes shown and bolted to a piece of hardwood 2 by 4 stock. The two pieces of flat iron are pivoted near the top so that a fork is provided in which the work lies, one side of the fork being bent so that it can be slipped under the work to be lifted.

—A. S. Wurz, Jr., Rockyford, Alta., Can.

Keeping Firing Tools Out of Sight And Close to Stove



In order to keep the shaker and poker for my heating stove close at hand, yet out of sight, I hung them on the back of the stove. I used wire coat hangers to do this. The hangers were bent as shown, and hooked over the top of the outer casing, first re-

moving the top of the stove to get the hangers in place.

—W. E. Boswell, Greenville, N. C.

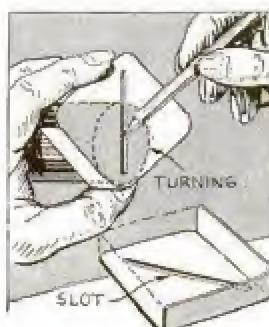
Lengthening Nails Used as Hooks To Hang Things on Walls

When a nail that has been driven into a wall to hang articles on is too short for the thing at hand, you can lengthen it by slipping a 6 or 8-in. length of small pipe over it. This idea is especially handy when it is not desired to drive long, large nails into a wall.

—Theron G. Cady, Palo Alto, Calif.



Lathe Work Centered Quickly With Tin-Box Cover



A centering gauge for round lathe-turning stock can be made by cutting a diagonal slot across a tin-box cover, such as that of a typewriter-ribbon box. The box is used by placing it on the end of the

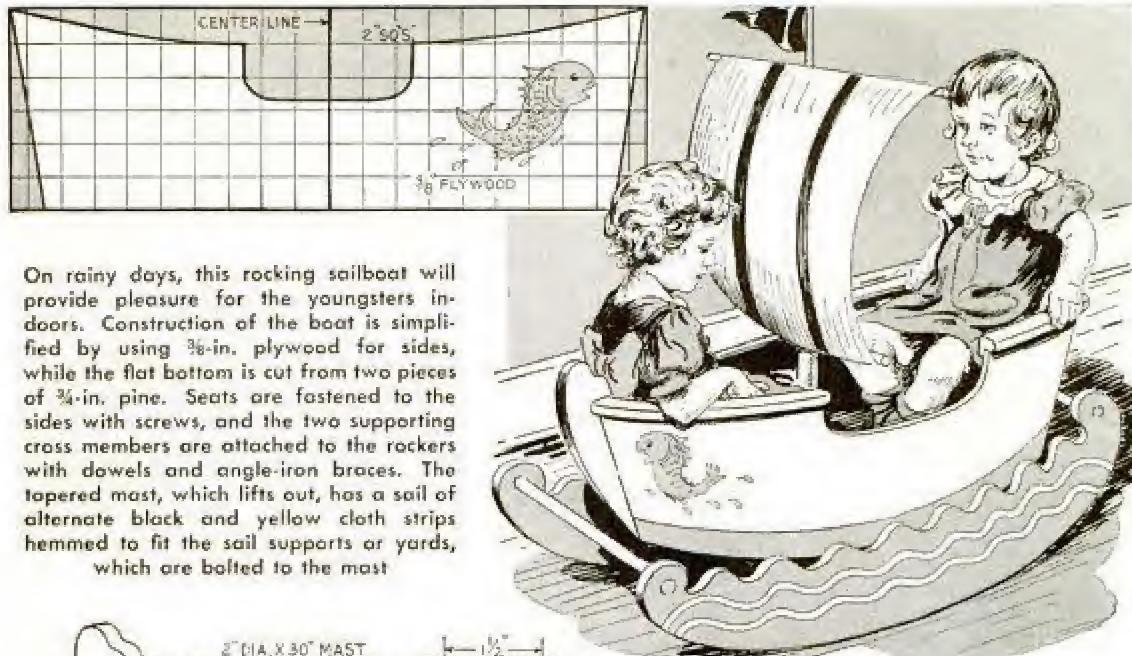
work as shown and marking through the slot, then turning it 90 degrees and making another mark.

Pieces of Pipe Bolted Together Make Emergency V-Block

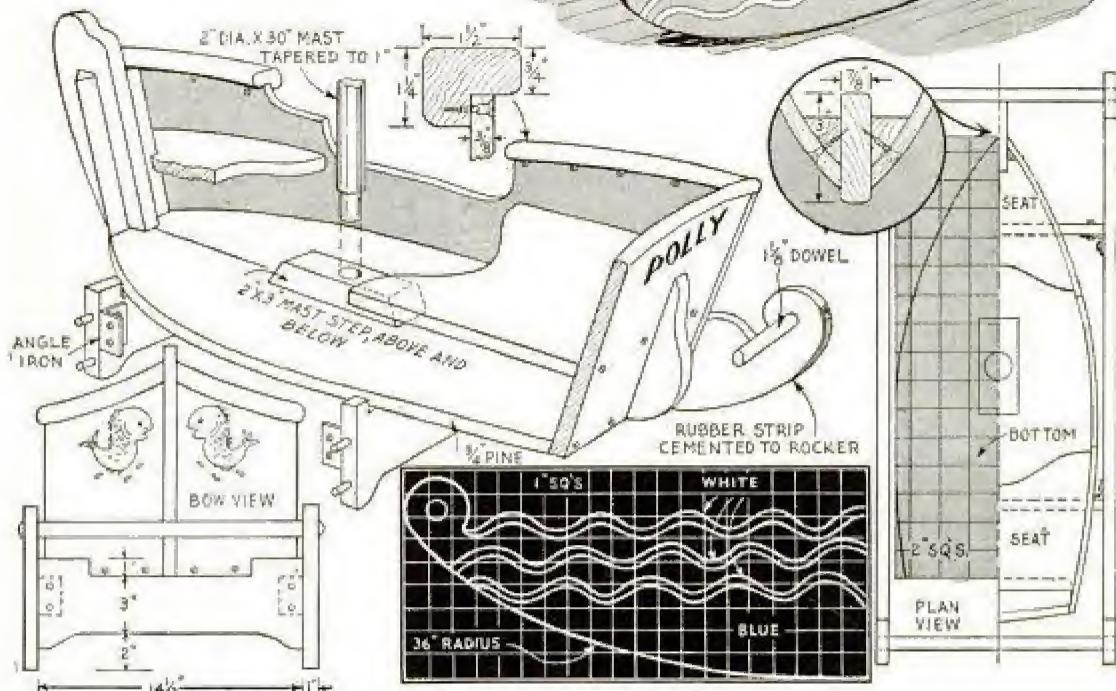
If you need a V-block to support round work for drilling and there is none at hand, you can make one from two pieces of pipe by bolting them together. The size of pipe to use will be determined by the size of work.



Crew of Two Can "Sail" in This Nursery Yacht



On rainy days, this rocking sailboat will provide pleasure for the youngsters indoors. Construction of the boat is simplified by using $\frac{3}{8}$ -in. plywood for sides, while the flat bottom is cut from two pieces of $\frac{3}{4}$ -in. pine. Seats are fastened to the sides with screws, and the two supporting cross members are attached to the rockers with dowels and angle-iron braces. The tapered mast, which lifts out, has a sail of alternate black and yellow cloth strips hemmed to fit the sail supports or yards, which are bolted to the mast.



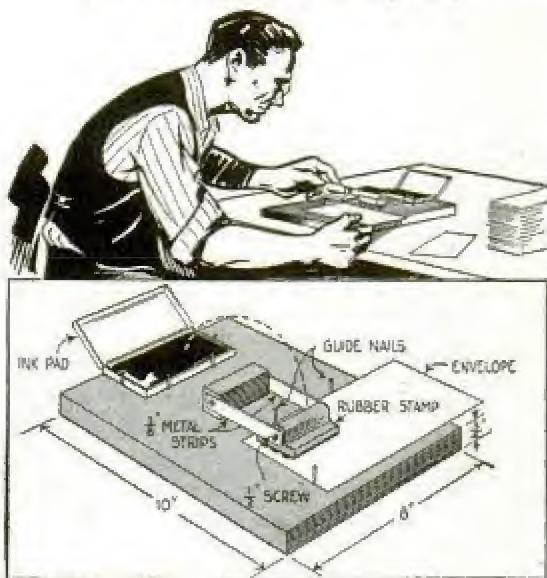
Thin Coating of Paraffin Improves Shot Used in Air Rifles

At a recent air-rifle meet, one of the contestants consistently outshot all others. Upon examining the shot used by the winner, it was found coated with a thin film of paraffin, which had been added to reduce friction and thus increase range and accuracy. To coat the shot, a small piece of paraffin was melted in a pie tin set over an alcohol burner near an open window,

after which just enough shot was added to take up most of the paraffin. The finishing touch consisted of quickly dumping the shot into a tub of cold water on the ground about 10 ft. below the open window.

¶Slices of onion barely covered with water in the bottom of a deep bowl will tend to draw the odor of paint from a room.

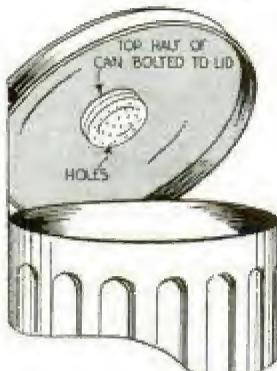
This Homemade Printing Outfit Handles Work Rapidly



Having several hundred envelopes on which I wanted the return address stamped, I made up this simple printing set to do the job rapidly. It consists of an ordinary rubber-type printing set, the holder of which is pivoted to a block in such a position that it can be swung over on a stamp pad and then back onto the work. By arranging a couple of stop pins or guide nails so that the portion of the work to be printed will always be in the same position under the stamp, the job can be done very rapidly. Be sure to close the cover when you have finished to prevent drying of the ink pad.

—John A. Zampino, Brooklyn, N. Y.

Repellent Will Keep Insects Out of Garbage Can



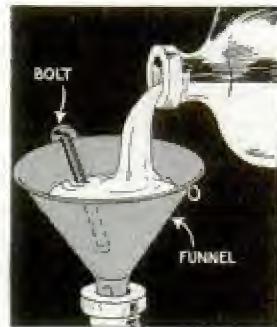
Insects and pets will not try to get into a garbage can if there is a strong odor of ammonia inside it. A good way to keep the ammonia in it is to fasten a perforated shoe-polish can to the garbage-can cover as indicated. If the lid of the polish can is bolted or soldered to the cover, the lower part of the can is removed easily for replenishing the ammonia when-

ever it is necessary. The polish can is packed with cotton to retain the ammonia, the fumes of which are dissipated slowly into the garbage can.

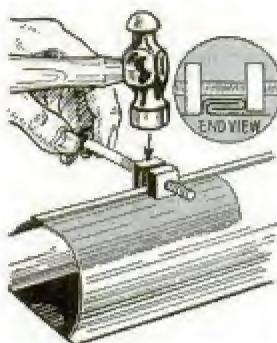
—John Krill, Youngstown, Ohio.

Bolt Hung in Top of Funnel Speeds Flow of Liquids

When using a funnel to fill a container, passage of the liquid through the funnel can be speeded up by hanging a bolt over the edge as shown. This tends to prevent the liquid from whirling as it is poured and permits it to feed through the funnel neck faster with less danger of spilling.



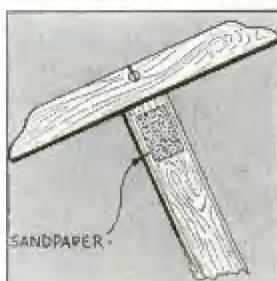
Improvised Tool Is Handy to Use For Locking Smoke-Pipe Seams



Next time you order some stove or smoke pipe and it is delivered with the seams unlocked, make this simple tool and it will enable you to lock them in a jiffy. The tool consists of a bolt with two nuts turned onto it, the nuts being spaced a distance equal to the width of the seam to be closed.

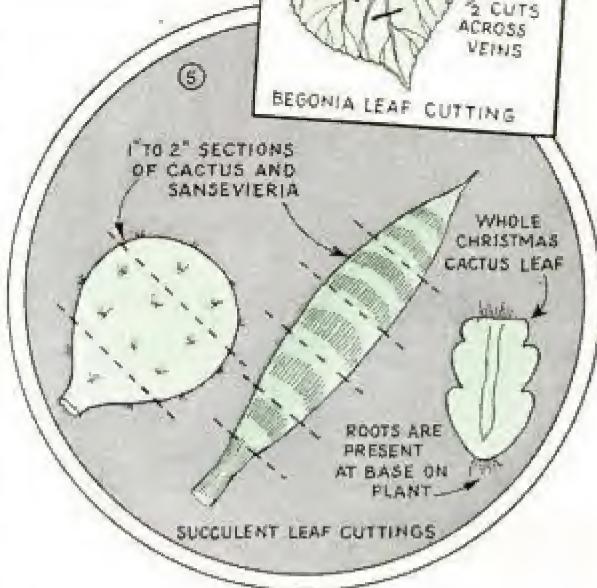
T-Square Kept From Slipping By Piece of Sandpaper

You can keep a T-square from slipping on a drawing board, and hold it steady without undue finger strain by using a piece of sandpaper. This is glued, sanded side out, to the underside of the blade of the square as shown in the illustration.



HEALTHY PLANTS grown from cuttings

by Bess Living

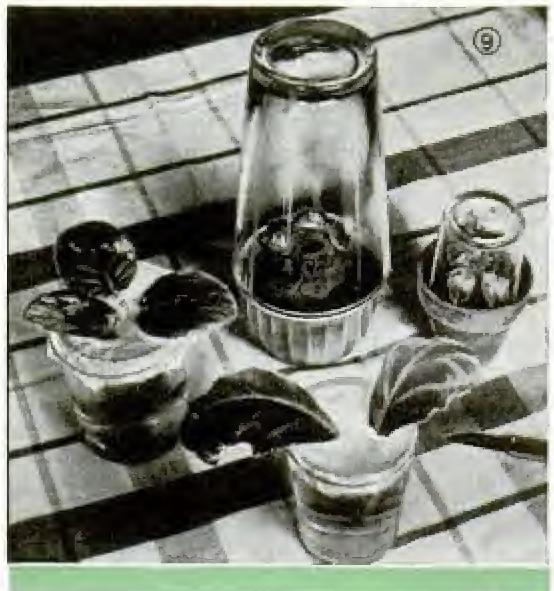
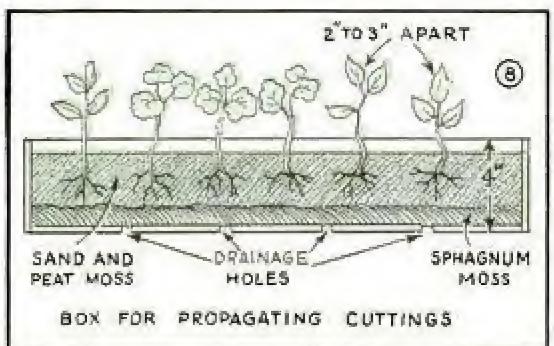
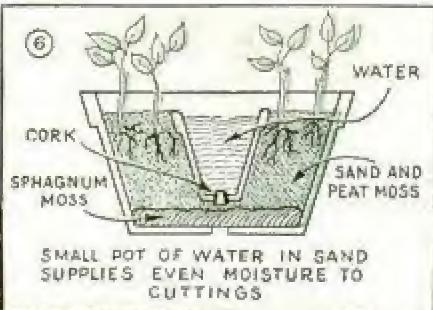


YOUNG plants grown from cuttings make excellent gifts, bridge prizes, or bazaar items, besides adding materially to your own window garden. Favorite plants can thus be shared or exchanged with friends and neighbors. Many outdoor annuals can be started in this way for winter blooming indoors. Petunias, verbenas, lobelias and dwarf snapdragons are particularly adaptable.

Stem cuttings and leaf cuttings are two types used in propagating house plants. Stem cuttings are made from softwood plants, such as geraniums, coleus, impatiens, heliotrope, fuchsia and lantana, as well as ivy, philodendron, periwinkle, marguerite, flowering maple, and some begonias. Brittle, young shoots that break with a snap when bent should be chosen. Those that bend without breaking are too old, and those that crush are too young to root rapidly. A clean cut is made at a slant with a sharp knife or razor blade just below a node (the point where the leaf joins the stem), Fig. 1. No cutting should be more than 6 in. long. Lower leaves are removed and the largest ones trimmed to prevent wilting. All flowers and buds are taken off. It is advisable to include a small piece of the main stem in cutting side shoots. This is called "heel-cutting," Fig. 3.

Leaf-cuttings are made from succulent and fleshy-leaved plants, such as African violet, gloxinia, begonias, crassula, eche-

veria (hen-and-chickens), sansevieria, and cacti of the Opuntia (prickly pear) type. Begonias and gloxinias grow readily from leaves in which $\frac{1}{2}$ -in. cuts have been made across several of the thick veins radiating from the base of the leaf, Fig. 4. These are placed flat on moist sand in a propagating box or pot and are weighted down with pebbles. A plantlet will appear at each cut. Or a leaf cut into triangular sections, each with a strong vein near the center, will produce a new plant when the point is buried in moist sand, Fig. 2. Many plants start from leaves with stems attached. Some of these are English ivy, peperomia, African violet, gloxinia (which develop



tubers at the base), and hoya (wax plant). Hyacinth leaves often form bulbils at the base. All these can be rooted in either sand or water. Succulent cuttings, such as sansevieria leaves and cactus pads, which are cut into 1 or 2-in. sections, should be exposed to the air to dry for a few days before planting. This callouses the cut and helps prevent decay. Crassula, echeveria and crabs claw (Christmas) cacti start from whole leaves, and branched cacti from severed branches treated in this way, Fig. 5.

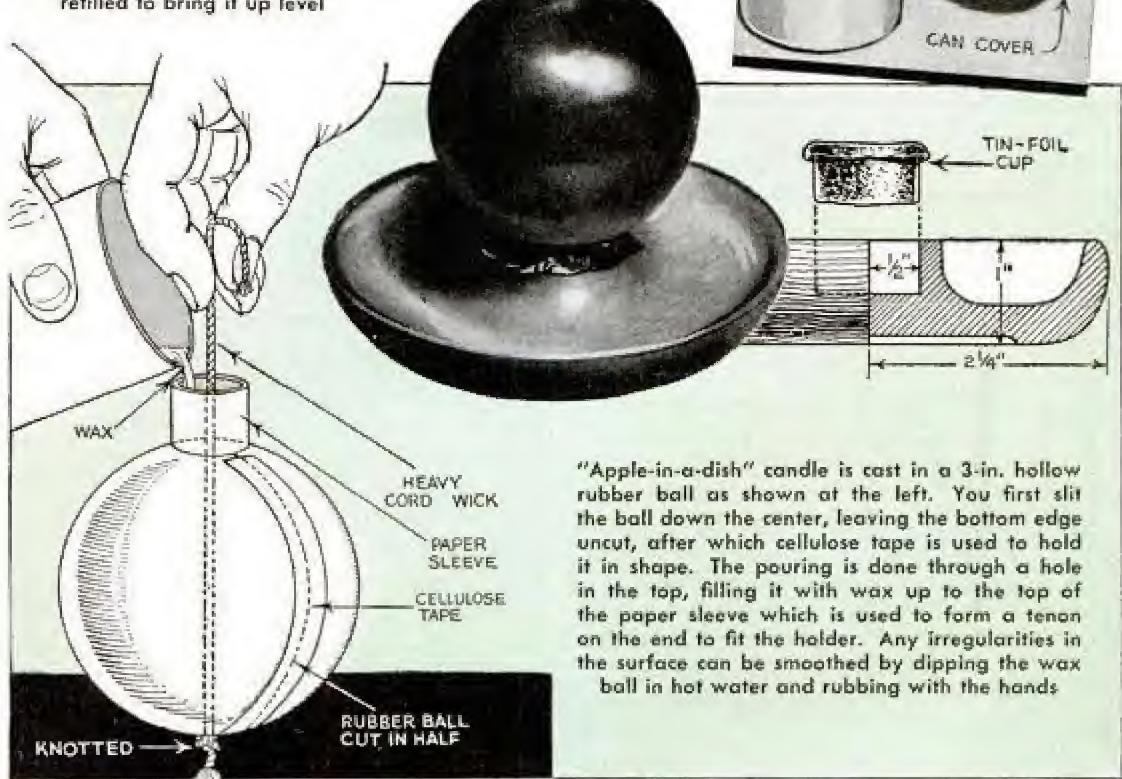
Sand or a mixture of sand and peat moss is the favorite medium in which to root cuttings, but many kinds of plants root well in clear water. Clean, gritty sand free from pebbles is used. Sterilizing by baking helps prevent damping-off and decay from fungi. Sand is placed in containers at least 4 in. deep, clay pots or wooden boxes with drainage holes in the bottom. A layer of sphagnum moss over the holes keeps the sand from running out. The sand is leveled and soaked thoroughly with water, then packed down firmly. Cuttings are planted in rows 2 or 3 in. apart in holes made with a pointed stick, inserting them just deep enough to hold them upright, Fig. 8. Loose sand is pressed around the stems and watered with a fine sprinkler. Cuttings should be shaded or kept out of sun and strong light for a week or so after planting to prevent wilting. Sand must be kept as uniformly moist as possible. Covering cuttings with glass tumblers or jars will preserve humidity, Fig. 9. But no water should be allowed to stand on the leaves. Containers may be watered from below by placing them in a pan or saucer of water and adding more as it is absorbed. Another way of supplying even moisture is by sinking a small pot inside a large one filled with sand, plugging the hole in the small one and filling it with water, which gradually seeps through it and moistens the sand, Figs. 6 and 7. Most plants will root in from 10 to 30 days, the appearance of new leaves indicating the presence of root formation. When roots have become $\frac{1}{2}$ to 1 in. long, cuttings are moved to small pots of sandy loam. When roots fill these they are transplanted to the next size and so on until the plant is full grown.

STUBBY GIANT CANDLES

easily made at home

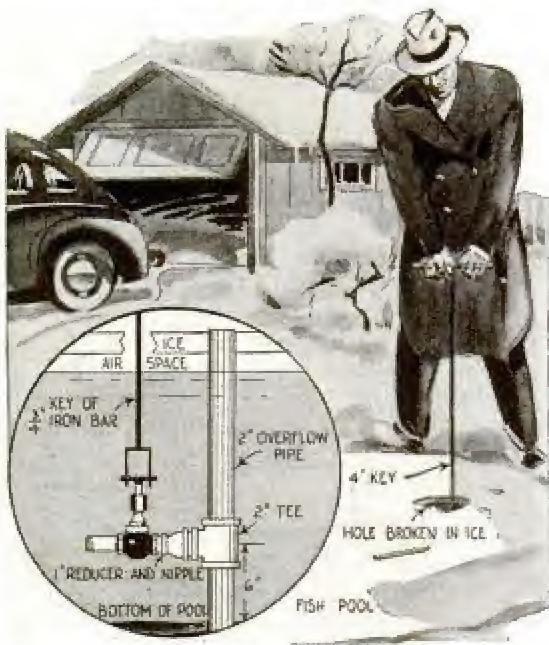


Glowing, translucent shells—that's what these decorative candles become when lighted, as only the center melts, leaving a wall around the flame. A No.-2 can is used for a mold to cast the candle shown above. The cover of the can is laid on the bottom, suspended by the wick, and the can is lined with waxed paper to facilitate removal of the wax. Pieces of candle of one color are melted in a can set in hot water and impurities are skimmed off the molten wax. The depression around the wick, caused by contraction as the wax cools, can be refilled to bring it up level.



"Apple-in-a-dish" candle is cast in a 3-in. hollow rubber ball as shown at the left. You first slit the ball down the center, leaving the bottom edge uncut, after which cellulose tape is used to hold it in shape. The pouring is done through a hole in the top, filling it with wax up to the top of the paper sleeve which is used to form a tenon on the end to fit the holder. Any irregularities in the surface can be smoothed by dipping the wax ball in hot water and rubbing with the hands.

Lower Fish-Pool Water Under Ice To Provide Air Space



One home owner who has a fish pool in which the fish are left throughout the winter prevents them from smothering when the pool is frozen over by lowering the water level to provide an air space under the ice. The water is lowered as indicated in the circular detail. A tee is put in the overflow pipe and a valve screwed into it. Then, when the pool is frozen over, he breaks a hole in the ice directly above the valve and opens it with an extension key, allowing the water to run out through the overflow to provide the air space.

—Herbert F. Zeh, Cincinnati, Ohio.

An Aid When Mortising Hinges



of the mortise. The pencil lead, or graphite deposited on the hinge will be rubbed off

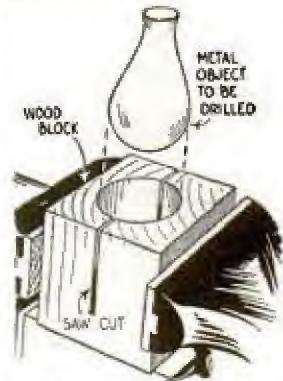
A good job of hanging a door with mortised hinges depends a lot on getting the mortise bottoms cut correctly. An aid in doing this is to rub the back of the hinge with a soft lead pencil and then rub the hinge firmly against the bottom

on the high spots, which can then be seen clearly for smoothing down.

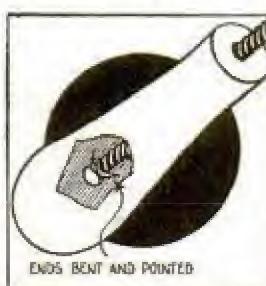
—T. K. MacDonell, Coconut Grove, Fla.

Auxiliary Wood Jaws to Hold Oval Work in a Vise

The next time you have a small oval piece of work that you want to clamp in a vise, make up a set of these wood jaws for the job. With them, the work can be gripped firmly in a vise without marring it in any way. The jaws are made from a block of soft wood drilled to take the work, and then split with a saw through the hole to get a good clamping action.—C. Hardy, Los Angeles, Calif.



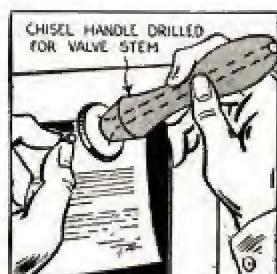
Fastening Twisted Wire Brushes Securely on Wooden Handles



If the handle of a twisted wire brush loosens, it may be tightened permanently as shown. The ends of the twisted wires are bent outward and slightly upward, after which they are pointed with a file. When pushed back into the handle, the sharp ends dig into the wood.

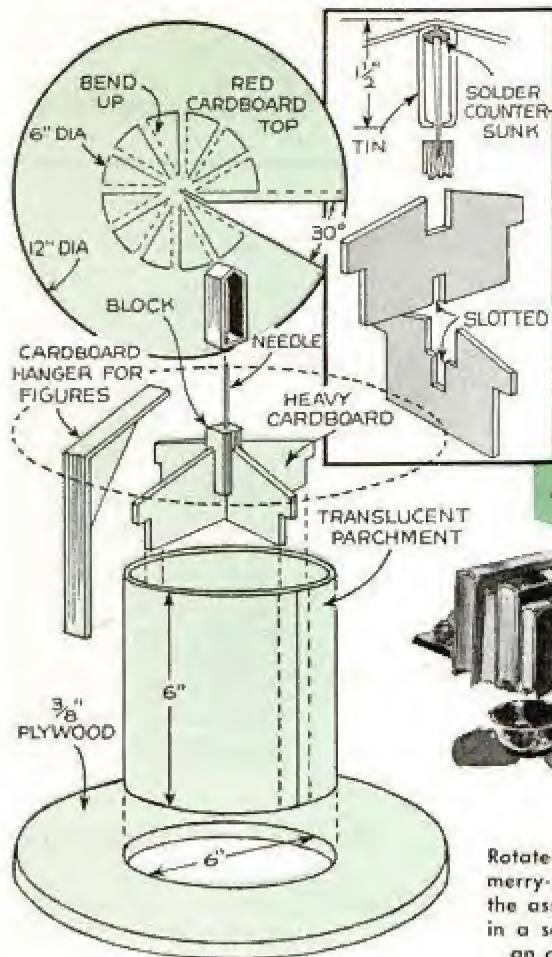
Auto Valve Used as Tack Hammer

A handy hammer for tacking up signs can be made by fitting an old auto-motor valve with a chisel handle. The latter is drilled to take the valve stem with a snug fit.



►A stiff feather will be found ideal for dusting the rigging on a ship model.

Warm Air Drives This Lamp Merry-Go-Round



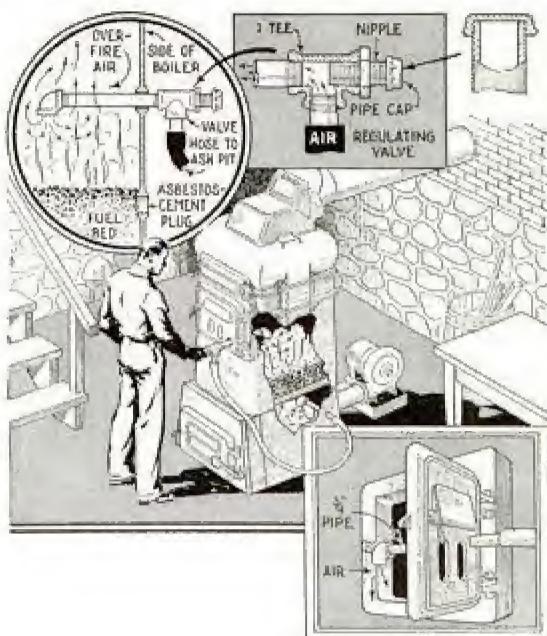
Rotated by a current of warm air rising from a lamp bulb, this merry-go-round is an instructive novelty. The rotating part of the assembly is supported on the point of a needle, which fits in a solder bearing. A paper or parchment cylinder fits over an opening in the base to provide a flue for the rising air.

Stream of Air Above Fuel Bed Consumes Waste Gases

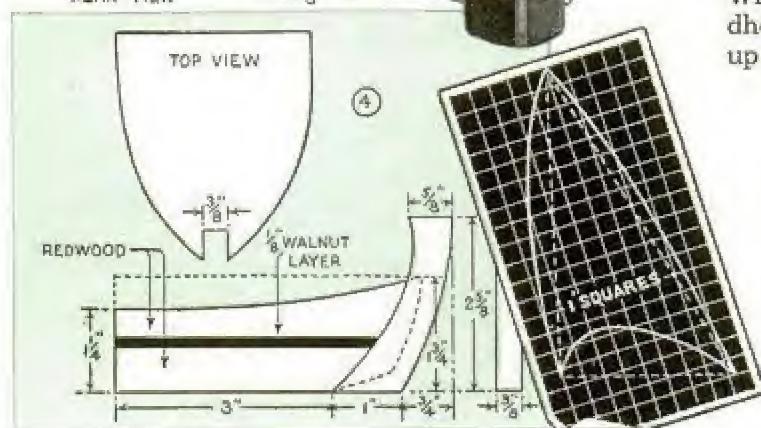
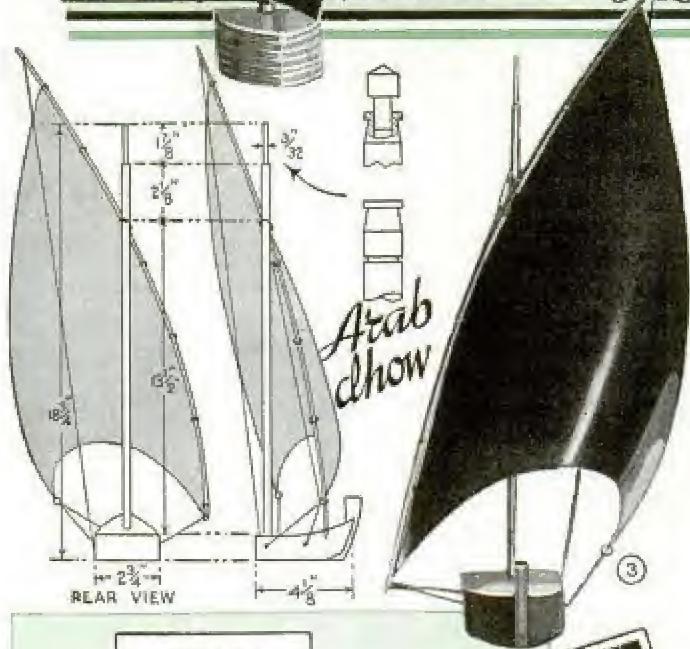
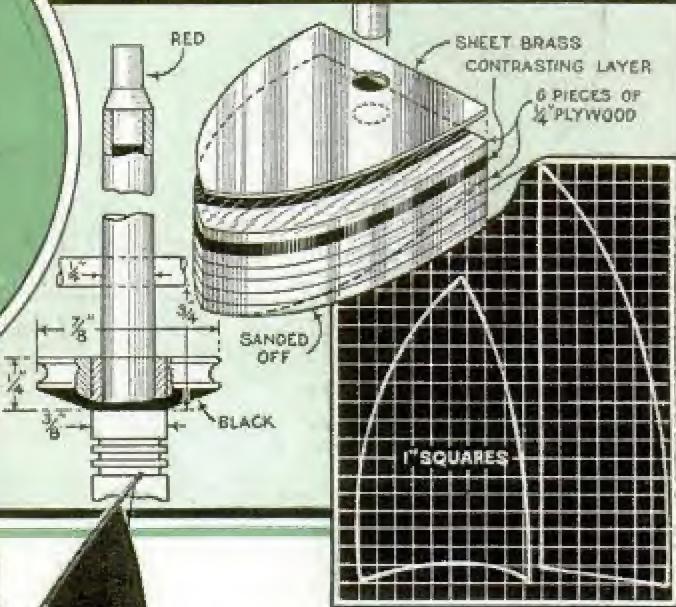
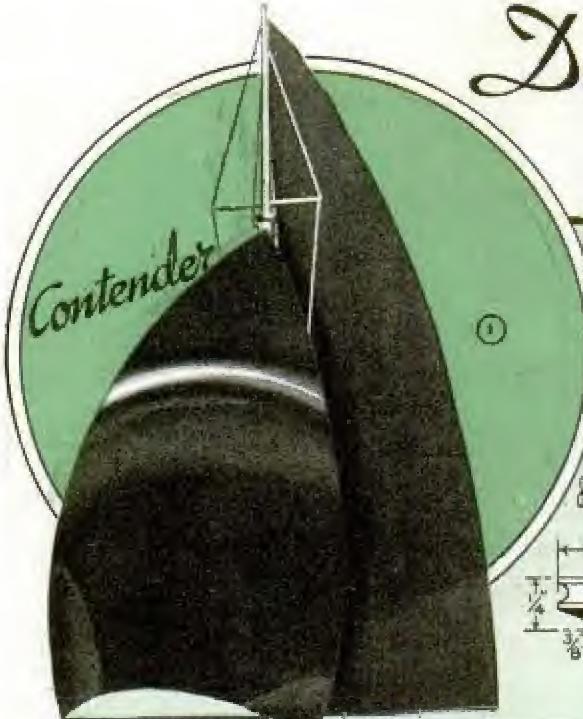
By directing air above the fuel bed of a heating plant in which a blower is used to burn buckwheat coal, gases that ordinarily escape up the flue are consumed, and the possibility of mild explosions of accumulated gases from careless firing is reduced. To make the installation, the air is carried from the ashpit by means of two lengths of pipe and a rubber hose as shown. The pipe above the fire can be run in through a hole in the fire door, or it can be taken in through any other convenient opening. If run through the fire door, it must be short enough to permit opening the door. A valve to control the flow of air can be made from a tee, a nipple and a pipe cap as shown in the upper detail.

—R. Boettigner, Englewood, N. J.

QYou will find that cheese will grate more easily if it is chilled first.



Decorative SHIP of metal and

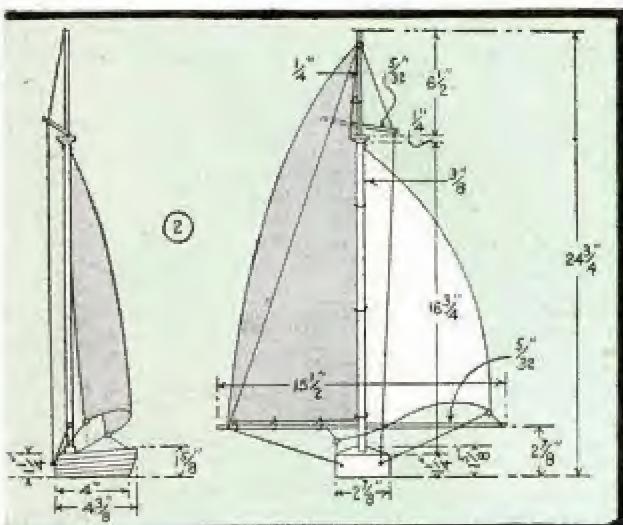


By Walter T. Warde

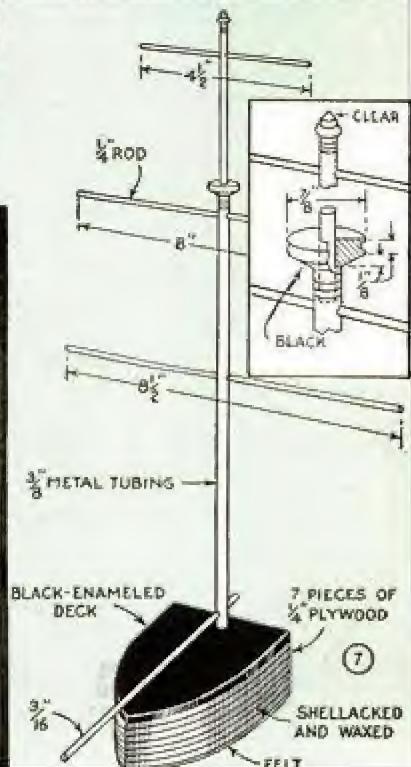
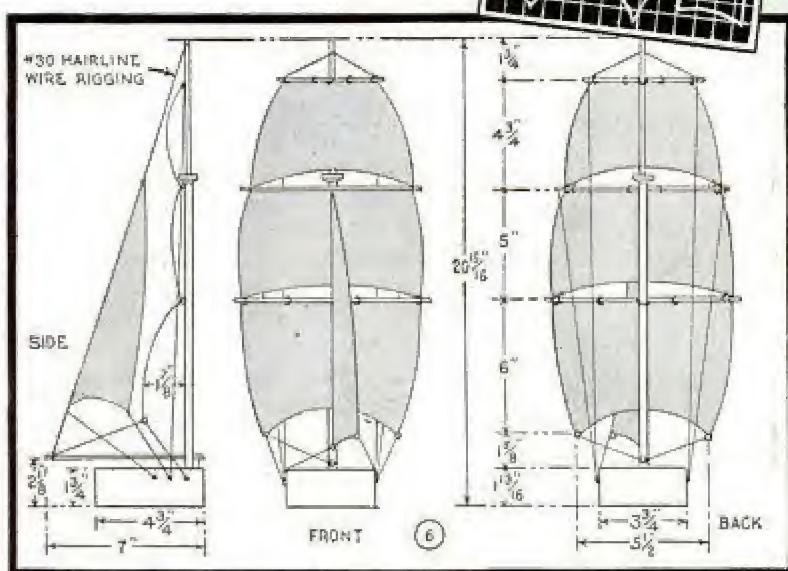
WITH sails of metal and contrasting hulls of laminated woods, these ship plaques offer something new in wall and mantel decoration. If available, "paper thin" plastic will give a colorful effect when used for the sails, in which case the rigging is relied upon to hold them in shape. All five models, Figs. 1, 3, 5, 9 and 10, are of similar construction. With the exception of the Arab dhow, Fig. 4, the hulls are built up from scraps of fir plywood, the plies of the wood providing an attractive decoration. For variation, a layer of colored plastic or wood may be sandwiched between the pieces as indicated. The hulls are finished with shellac and wax. Fig. 7 shows how the mast and yards of the windjammer are attached, the others being

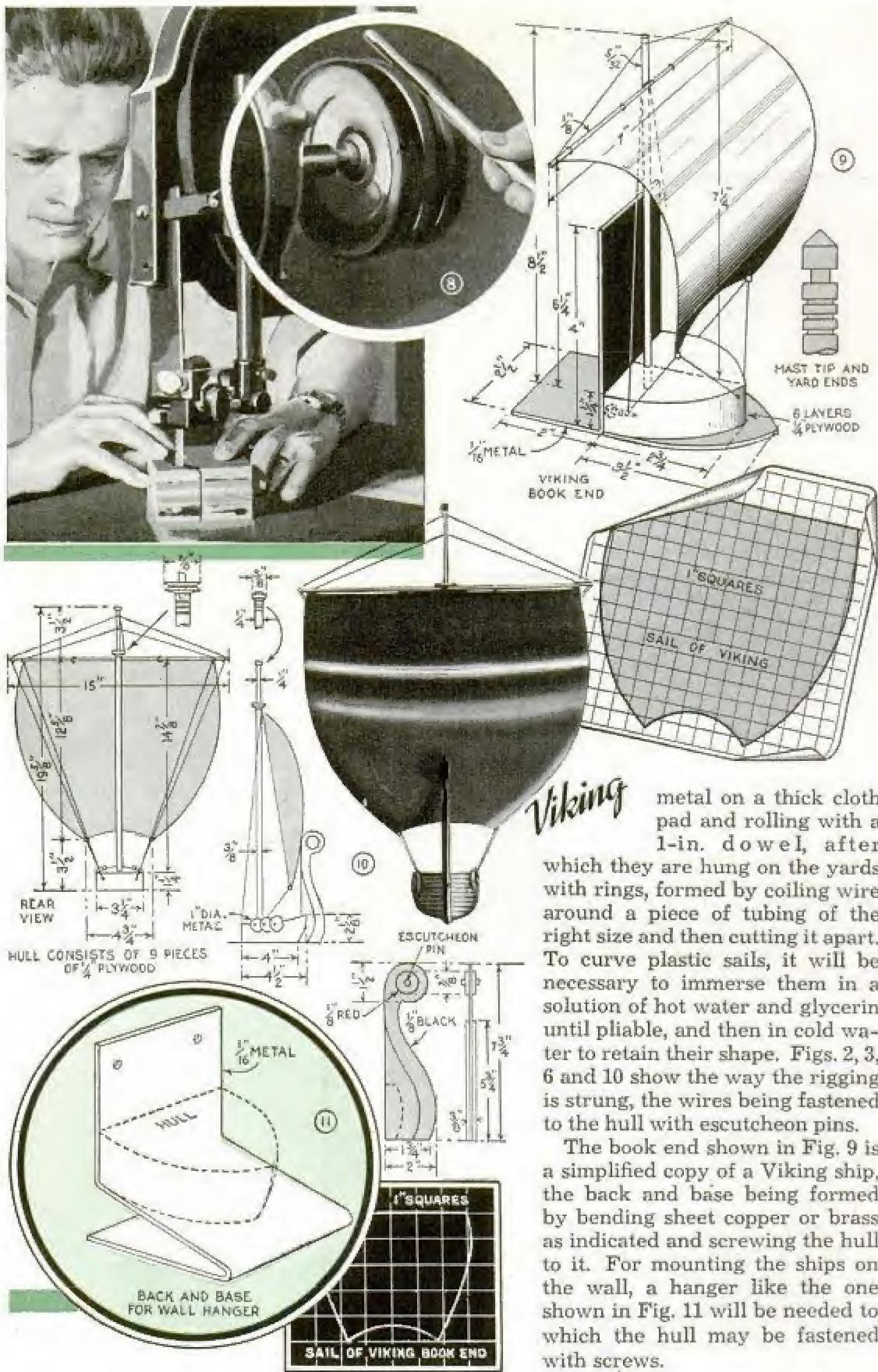
PLAQUES

wood



fitted similarly, while Fig. 6 gives the correct spacing of the yards for drilling the two-part mast. The metal is buffed to a high luster as in Fig. 8, and then given a thin coat of shellac or lacquer to prevent tarnishing. The upper part of the mast fits tightly inside the lower piece at the crow's-nest. The sails are bellied by placing the



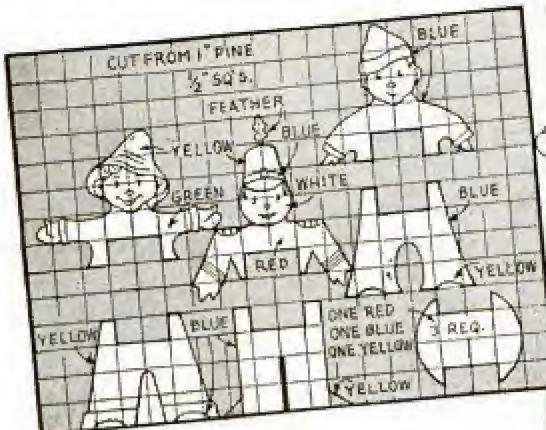


Viking

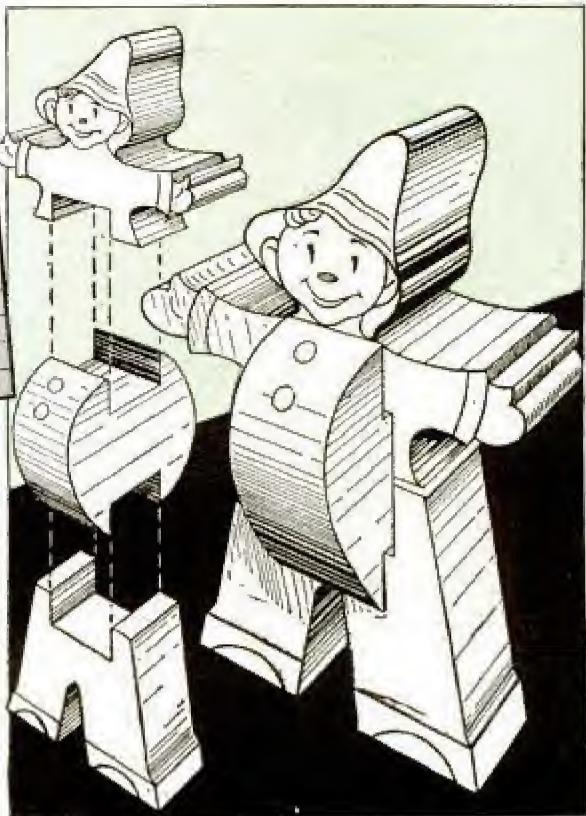
metal on a thick cloth pad and rolling with a 1-in. dowel, after which they are hung on the yards with rings, formed by coiling wire around a piece of tubing of the right size and then cutting it apart. To curve plastic sails, it will be necessary to immerse them in a solution of hot water and glycerin until pliable, and then in cold water to retain their shape. Figs. 2, 3, 6 and 10 show the way the rigging is strung, the wires being fastened to the hull with escutcheon pins.

The book end shown in Fig. 9 is a simplified copy of a Viking ship, the back and base being formed by bending sheet copper or brass as indicated and screwing the hull to it. For mounting the ships on the wall, a hanger like the one shown in Fig. 11 will be needed to which the hull may be fastened with screws.

Many Variations Are Possible With These Dolls



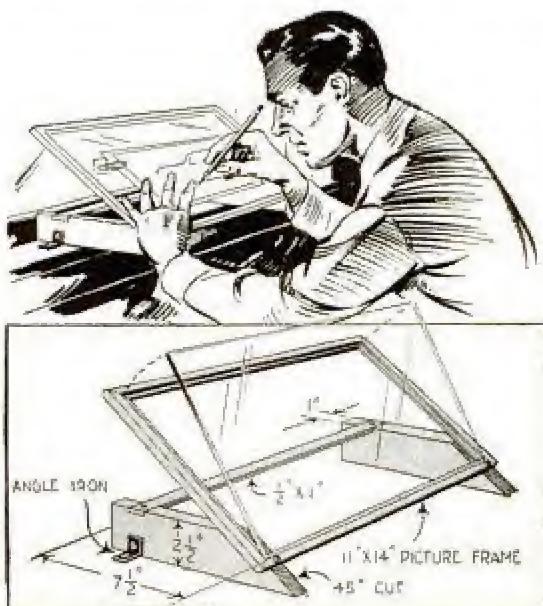
Any small child will be delighted with these three block dolls. The parts of each one are interchangeable, making many variations possible. On all three the center sections are the same but the legs and head-and-shoulder pieces are different. Be sure that the pieces are notched carefully so they will fit together snugly. The squared detail gives the sizes and various shapes of the different pieces along with a suggested color scheme.



Tracing Easel Made From an Inexpensive Picture Frame

You can make a tracing easel that will enable you to copy maps and designs, work on negatives and the like, by means of natural or artificial light. All you need is a

11 by 14-in. picture frame and glass, a small piece of 1-in. white pine and a couple of small angle irons. First, make up a frame of 1-in. stock as indicated, beveling the front ends at a 45-degree angle. Then attach the picture frame to the beveled portions of the ends with screws, and screw the angle irons to the sides as shown, to serve as brackets. This completes the easel. In use, it can be attached to a window sill by means of the angle brackets to use natural light. Lowering the window shade so that light passes only under the frame will help.—R. W. Corrigan, Mahaffey, Pa.



WRITE FOR POPULAR MECHANICS!

Readers are paid cash for ideas printed on these pages. You too, may know of a simpler, faster or better way to do some daily chore about the home, farm, office, shop or garage; an aid to amateur photographers, model makers, workshop fans, car owners, hobbyists, etc. Or, perhaps it's something of unusual juvenile appeal. Just send a short but complete description plus a sketch or photo to the Homecraft Editor of Popular Mechanics. Checks sent promptly for accepted ideas.

Dust Cleaned From Typewriter By Using Compressed Air



Dust and lint combined with the lubricant on a typewriter will soon gum the moving parts so that they work hard. To avoid this, just take the typewriter to your local filling station and ask the proprietor if you can use the tire hose to blow out the dust. Doing this occasionally will make frequent dismantling and cleaning of a typewriter unnecessary.

Books Having Covers Interlocked Easy to Carry in Your Arms



When carrying a number of books, just put the cover of one inside that of the one next to it as shown. This tends to interlock the books so that one cannot slip off easily.

Coloring Crack Filler to Match The Surrounding Wood

In filling cracks or saw marks in jigsawed wooden figures, such as blocked letters for window display signs, a very serviceable filler can be made from show-card paint and fine sawdust. It is much faster than regular putty, for it can be used any

time after the figures have been painted, and leaves them completely finished as soon as dry. The filler is mixed by taking a dab of show-card paint and pinches of the fine sawdust, mixing them with a knife to the consistency of cake frosting.

—Don W. Sigler, Lincoln, Nebr.

Skin Taken Off Top of Paint With Raveled Screen Wire

Screen wire tacked to a stick, then raveled at the end makes a handy paddle for removing the thin skin that forms on top of a bucket of paint. The screen should be raveled for about 1 inch and the remaining wires spread slightly to form a kind of a broom, as indicated in the drawing.

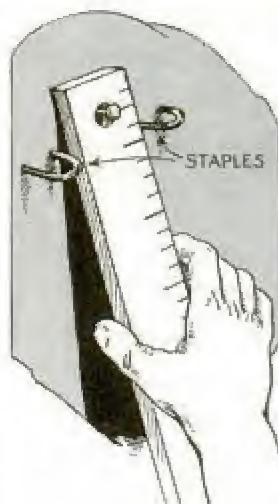


Remove Wax Before Painting

Paint will not dry properly over waxed surfaces, or if it does, the new paint will chip and scale shortly. It is best to thoroughly remove all wax with a cleaning solvent and, in turn thoroughly wash all surfaces to remove the solvent. Do not apply paint until surfaces are dry.

—Harold J. Ashe, Los Angeles, Calif.

Staples in Wall Guide Yardstick When Hanging It on a Nail



If you keep a yardstick hanging on a wall in your workshop, drive a couple of staples at each side of the nail on which the stick hangs, spacing them a distance equal to the width of the stick. These serve as guides so the stick can be pulled down over the nail, which will slip into the hole.

Simple MUSIC CABINET has 14 drawers

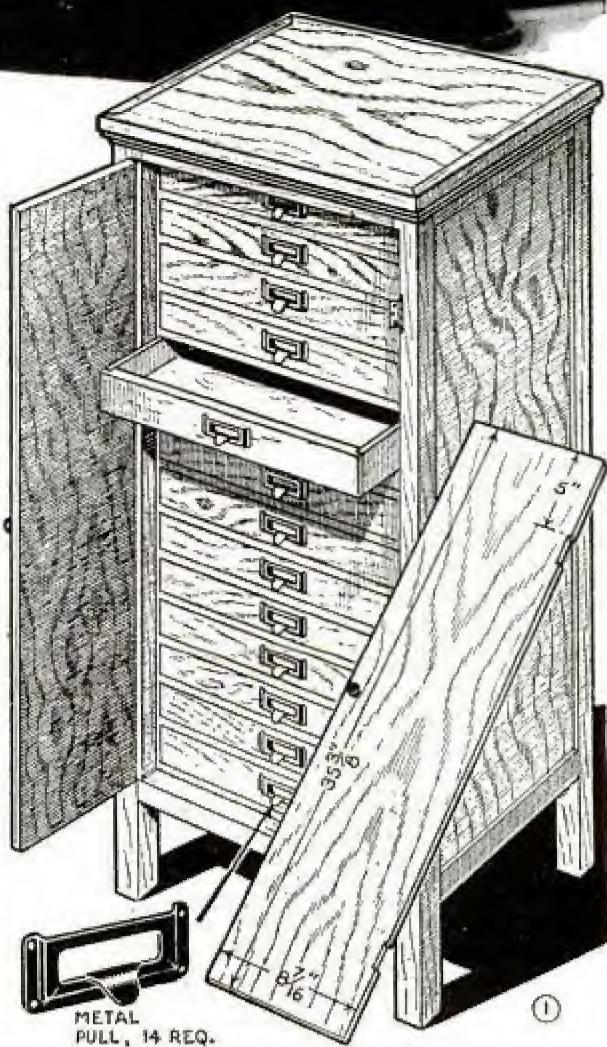


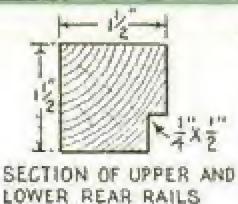
By George E. Ressler

CLASSIFYING your sheet music as to composer, type, etc., and filing it in the shallow drawers of this neat little cabinet, Fig. 1, not only makes it possible to select the desired copy quickly, but saves the numbers from becoming faded and torn with excessive handling.

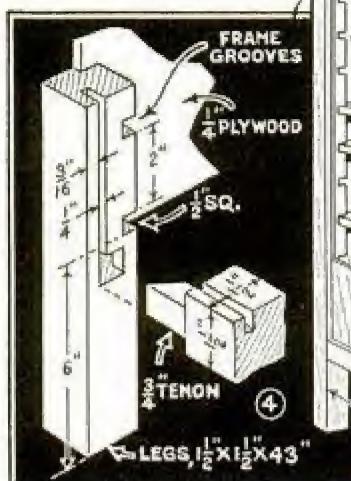
Plywood and solid stock are combined in the construction, Fig. 5 showing a cutaway view of the assembly. Grooves in the back legs to house the fifteen drawer frames are made first. These are cut $\frac{1}{2}$ in. deep across one face of the stock and enter a rabbet for the back panel as shown in Fig. 4. To assure identically spaced grooves in both legs, clamp the stock together temporarily and pass both faces over the saw at the same time. In each front leg a door rabbet, extending between the top and bottom crossrails, is made following the detail in Fig. 6.

Corresponding mortises to receive the tenoned crossrails can be cut accurately by hand by boring a $\frac{3}{4}$ -in. hole, Fig. 2, and then forming it square with a narrow chisel. Locate these mortises to bring the rail flush with





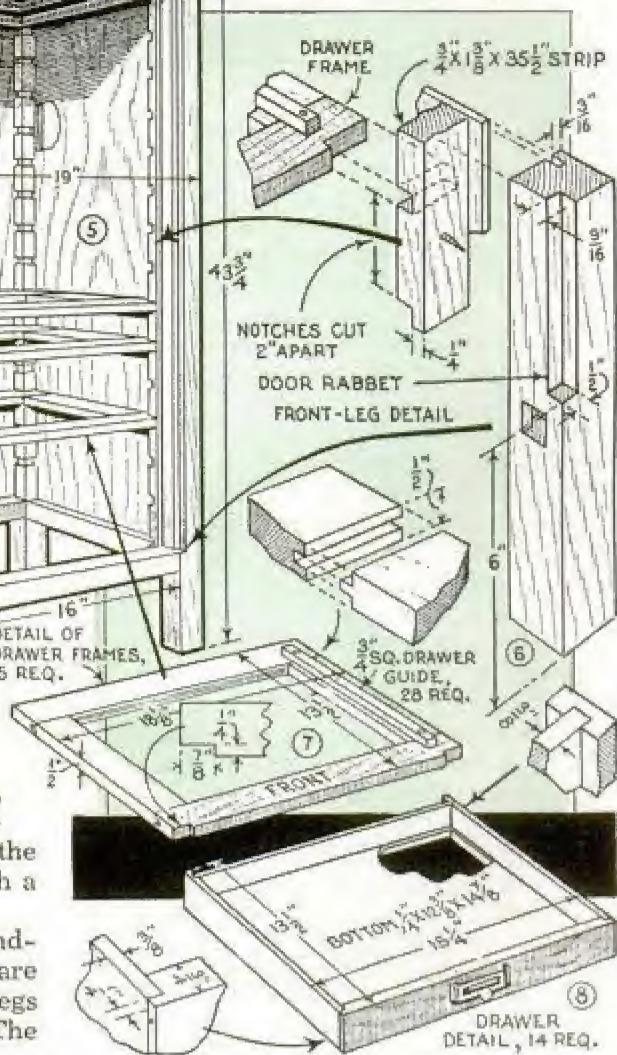
SECTION OF UPPER AND LOWER REAR RAILS



the face of the leg. In gluing the ends of the cabinet together, apply glue only to the tenons of the rails, leaving the plywood panels free to contract in the grooves. Fig. 3 shows how the top is held with cleats and finished with a cove molding beneath the overhang.

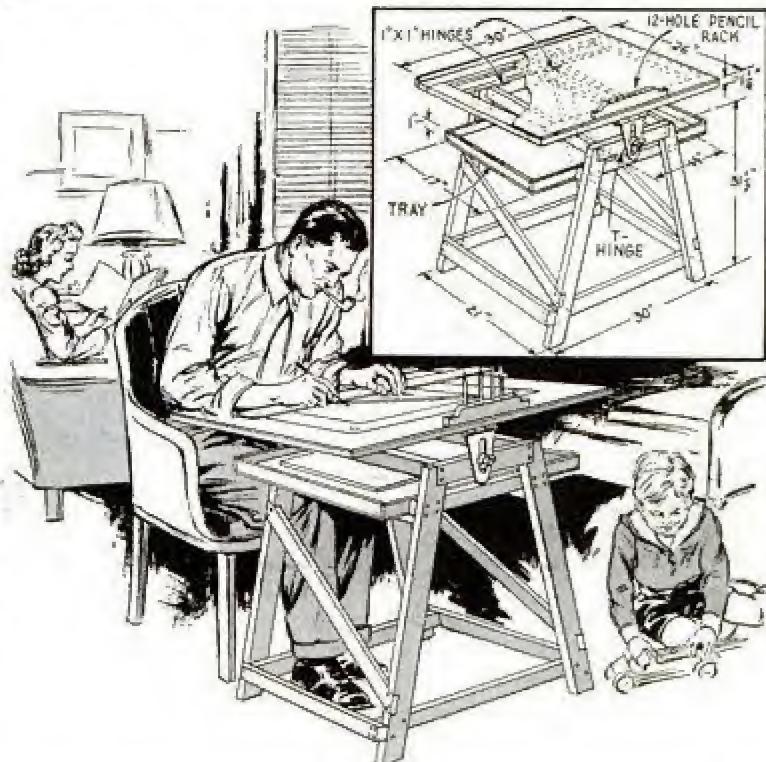
Now, strips having grooves corresponding with those cut in the back legs are screwed to the inner face of the front legs in line with those at the rear, Fig. 6. The

drawer frames, which are assembled and fitted with guides as in Fig. 7, are slipped in place through the back of the cabinet to engage the grooves at the front and come flush with the face of the strip. Fig. 8 details the assembly of the drawers which should be fitted with sufficient clearance to allow them to slide freely when finished. Only the fronts of the drawers and their frames are made of choice stock, the inner parts being assembled from cheaper wood to save cost. Small bullet-type friction catches fitted in the lower edge of the plywood doors keep them closed.



Utility Drawing Table for the Home Draftsman

After doing drawing at home for several years without a suitable drawing table, I designed and built this one in which are incorporated many ideas convenient for the home draftsman. The hard-pressed board top can be used as a drawing board, or as a table top for a regulation board. The wooden framework supporting it is hinged at the front end to one of the cross members. At the back, a slotted T-hinge permits vertical adjustment of the top. A tray under the top provides a place to keep drawing paper, drawing set, T-square, etc. It rests loosely on the frame cross members and is easy to remove for cleaning and rearranging. I purposely kept the front end of the table free of any supports to allow plenty of leg room. As you will notice, the lower side cross members are nailed to the outer edges of the legs. In this position, they form handy ledges on which to set an extra drawing board, letting it lean against the slanting legs. This is handy



in my case as I usually work with two boards. The pencil rack is a great convenience. The holes in it are $\frac{3}{8}$ in. and are spaced 1 in. apart. An important item to most draftsmen is an ash tray. I have one mounted on a swivel bracket at the extreme right side of the front of the table.

—Henry Ruskin, Chicago.

Nails Coated With Rosin to Make Them Hold Firmly



The next time you use nails where there will be unusual strain between the parts that are to be put together, treat the nails with rosin before using them. The rosin coating will make them less likely to pull out under the strain. To treat the nails, dip them in a solution mixed in the proportion of rosin, 1 lb., to benzol, 1 gal. After dipping the nails, allow the coating to dry before using them.

Removing Paraffin From Container

You can remove paraffin easily from a container in which it has been melted by filling the container with boiling water, then allowing it to cool. The paraffin will float on the surface of the water.

Iron Bucket Hooks on Stepladder Help the Painter



Two or three iron hooks and cross links from auto skid chains will enable you to hang buckets of paint or other material any place on a ladder conveniently within reach. The hooks are shaped to slip over the ladder steps, rungs or sides as desired, the open links of the skid cross chains being handy to take the bucket bails.

—W. Cleveland, Lake Tahoe, Calif.

Replacing Worn Veneer Seats With Upholstery

Worn veneer seats on metal stools and chairs can be repaired by making a new seat of $\frac{1}{2}$ -in. plywood and bolting this on top of the old seat. First cut the plywood to the shape of the original seat and drill three small bolt holes through it, drilling three corresponding holes in the old seat. Then upholster the new seat, pulling the material over the edge and tacking it to the



underside. Now put it in place, inserting the projecting bolts through the old seat and pulling them up tightly with nuts.

—Herbert Bast, Sheboygan, Wis.

Shipping Tags Mark Boat Parts To Be Repaired

One motorboat owner who checks over the motor and boat when time and weather permit during the winter months, marks the parts to be repaired with tags. By doing this, there is no possibility of overlooking some of the needed repairs when he is ready to overhaul the boat in the spring.



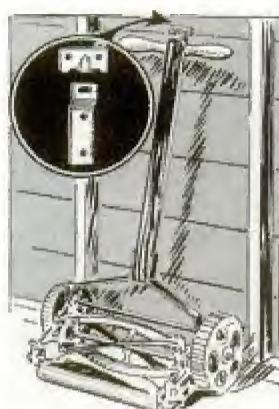
Scroll Invitations for Your Party



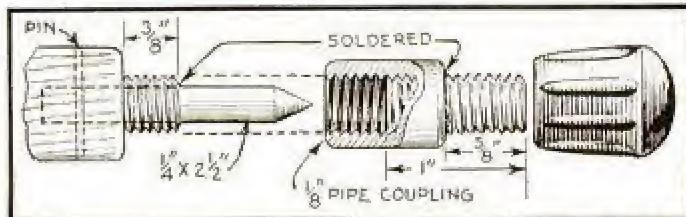
If you are looking for something unusual in the way of a party invitation, these scroll ones are just the thing—and fun to make. You will need some dowels for the sticks, heavy writing paper, a little gaily colored yarn and some cellulose tape. First cut the paper to the desired size and glue each end to a dowel. With the yarn form the letters of the writing and glue it to the paper.

Sash Hanger Holds Lawnmower Close to Garage Wall

To keep your lawnmower close to a garage wall, attach the lower part of a sash hanger on the handle and screw the hook part on the wall. With this arrangement, it takes only a minute to raise the mower and slip it on the hook.



Combination Rubber and Steel Feet for Tripods



Changed in a few seconds from rubber-cushioned to metal-pointed tips, these combination feet adapt your camera tripod to any surface. Each foot consists of a $\frac{1}{4}$ -in. steel rod, a $\frac{1}{8}$ -in. pipe coupling and a slip-on rubber tip, and two lengths of threaded brass tubing, the kind used on electrical fixtures, which has a $\frac{3}{8}$ -in. outside diameter and a pipe thread.

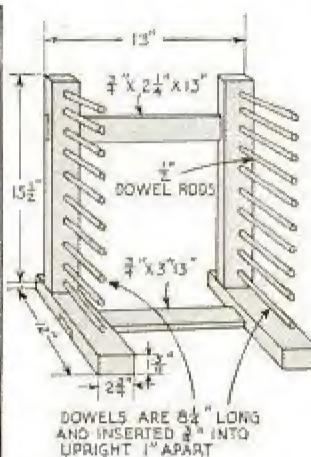
The parts are assembled as indicated in the upper detail. A $\frac{3}{8}$ -in. section of the threaded tubing is soldered to the rod $1\frac{1}{4}$ in. from the blunt end, which is then pinned into the tripod leg. Next, a 1-in. section of the tubing is screwed into the pipe coupling as indicated, and soldered. Then a rubber tip is screwed onto the projecting tubing. The hole in the tip is $\frac{7}{16}$ in. in diameter making a force fit. When you want a rubber foot to support the tripod on a surface to avoid marring, just screw the pipe coupling onto the steel foot.



Rack to Dry Ferrotyped Prints Is Assembled From Wood

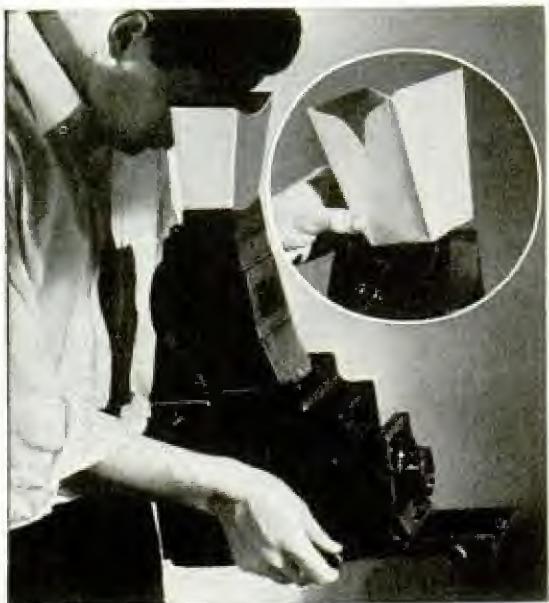
Accommodating ten 11 by 14-in. ferro-type tins, this handy rack can be assembled

from almost any kind of wood. Two vertical pieces are drilled for dowel rods, which are spaced 1 in. apart to allow free circulation of air. The rack can be made to hold more tins by increasing the length of the uprights and adding more dowels. For quick drying, an electric fan may be placed in front of the stand.



Mark the strap of your camera carrying case at 6-in. intervals with white pencil or paint and it will serve as a handy measure when taking closeups.

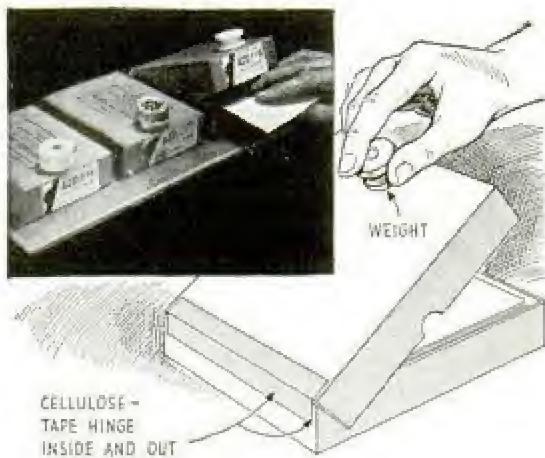
Auxiliary Hood on Reflex Camera Makes Focusing Easier



Placed in the opening of the focusing hood of a Graflex or other reflex camera, this extension hood will make focusing easier. It enlarges the opening so both eyes, especially if glasses are worn, can be used. Notice how a notch is cut on one edge to fit over the nose. The four sides of the extension hood are made of cardboard, fastened together with cellulose or adhesive tape. It is best to use black cardboard or paint the inside surfaces with flat black paint.—F. P. Schofield, Ardsley, Pa.

Self-Closing Photo-Paper Boxes

Boxes in which gross or half-gross lots of photographic paper are packed can be converted easily into self-closing compartments for storing different grades of



paper in the darkroom. The lid of the box is hinged to the bottom with cellulose tape and provided with a knob for lifting it. The knob should be heavy enough to cause the lid to close as soon as it is released. On the boxes shown, small porcelain electrical insulators served this purpose very well. Three or more boxes may be arranged on a baseboard to form a cabinet for each size and kind of paper commonly used.

Rubber Bands Hold Tripod Legs Between Regular Stops

Telescoping legs of a tripod can be held in any position between the regular stops if a few rubber bands are wrapped tightly around each leg. Just roll the bands to the spot where the leg is to be held and push the outside section of the leg against them. When the tripod is closed, the bands are rolled down to the bottom of each leg.



Tilting an Enlarging Easel To Correct Distortion

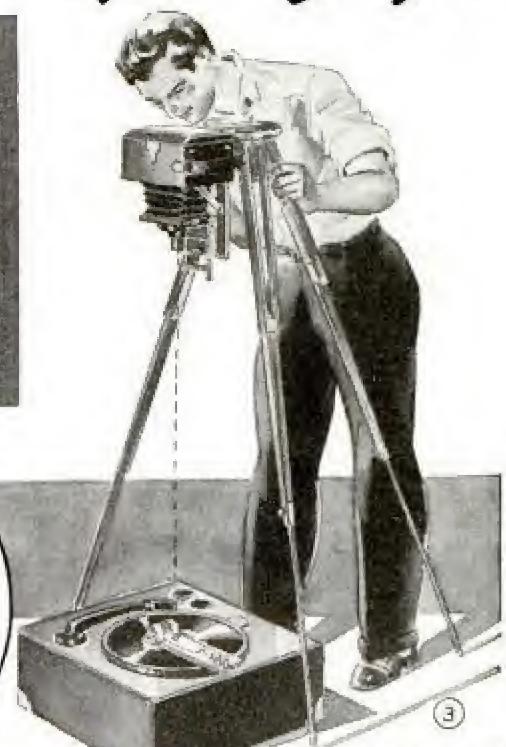
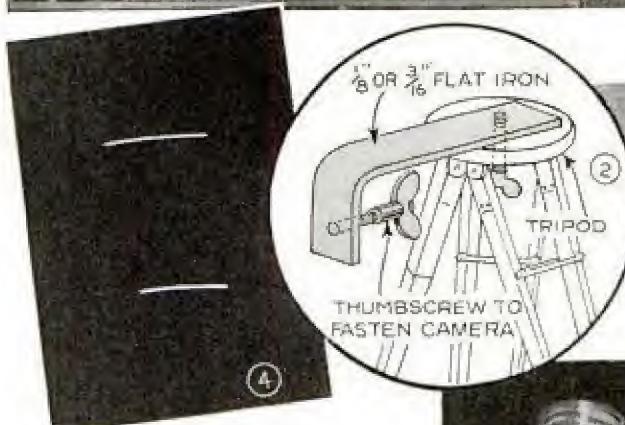
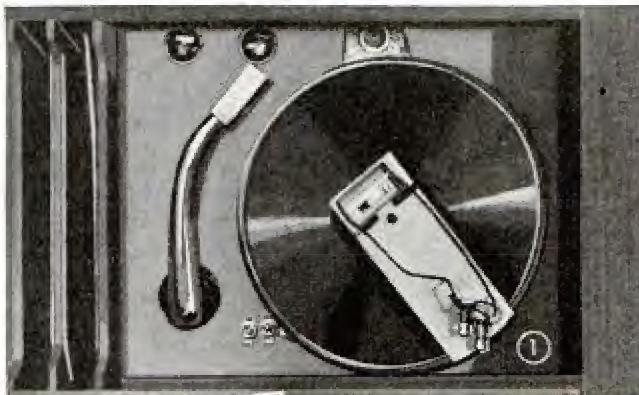


Distortion in photographic negatives frequently can be corrected by tilting the easel when an enlargement is made. A good way to do this is to use a desk-lid support fastened to the back of the easel as indicated. An angle brace is screwed to the easel and the lid support is fastened to it with a bolt and wingnut. If no desk-lid support is available, a piece of metal can be cut to approximately the same shape.

—Robert Scott, Saltsburg, Pa.

CAMERA SHUTTER SPEEDS

checked by twin lights on phonograph



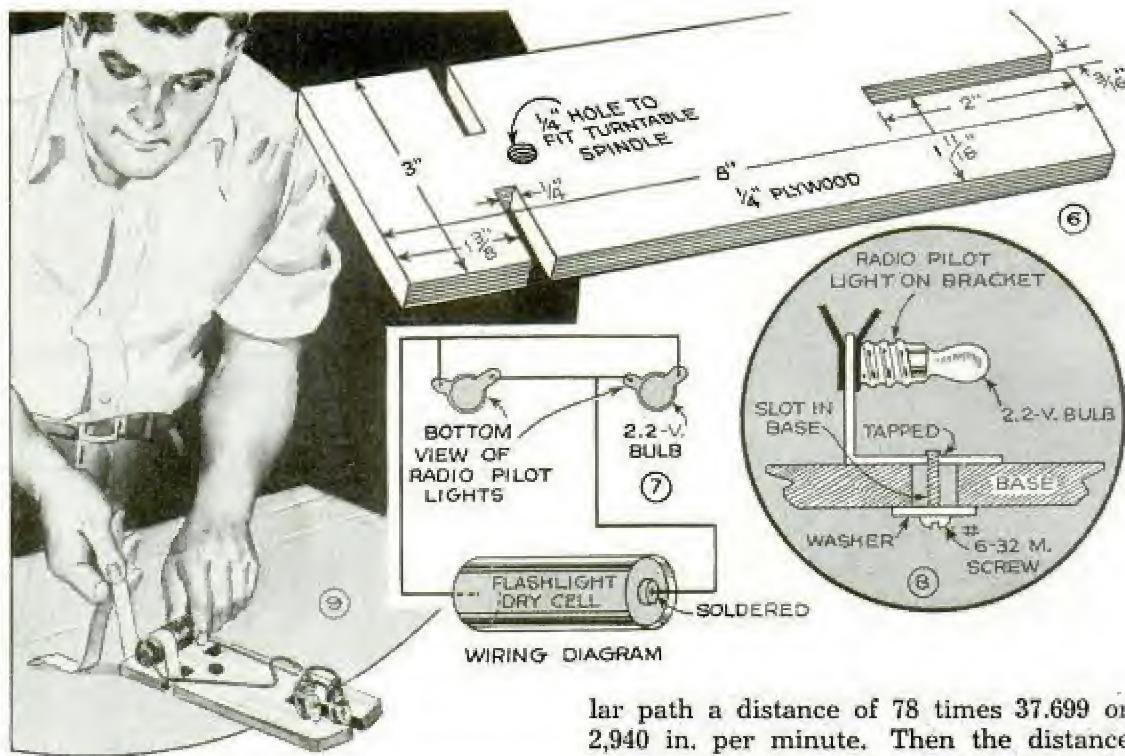
By S. Gordon Taylor

ON MANY cameras, shutter speeds may be highly inaccurate, so that the trusting amateur, shooting at a speed marked 1/300 second, may be exposing double or triple this time. At higher speeds, few cameras that have been in use for some time are as accurate as they were when new.

To check shutter speeds with precision is much simpler than one would suppose, and the average camera fan can do this with the aid of a phonograph and a home-made attachment that fits on the turntable as shown in Fig. 1. The attachment shown separately in Fig. 5 and detailed in Figs. 6, 7 and 8, has a hole at one end to fit the turntable spindle and a slot at the other end. Two 2.2-volt radio pilot lights are attached over the slot so that their exact distance from the center of the turntable spindle and the distance between them can

be adjusted. A flashlight cell is taped on as shown in Fig. 9, and it is wired to the lights as in Fig. 7. If desired, a small switch can be put in the circuit or one of the wires just hooked to some point to make and break electrical connection. The camera is arranged to make exposures of the turntable as in Fig. 3. If you make up a bracket as in Fig. 2, the camera can be held on any sturdy tripod in the position indicated.

Now you are ready to make the test. The idea is to make an exposure of the lights while they are rotating on the turntable. From the length of black streaks that appear on the negative, or white streaks if a print is made as in Fig. 4, you can tell if your shutter speed is or is not



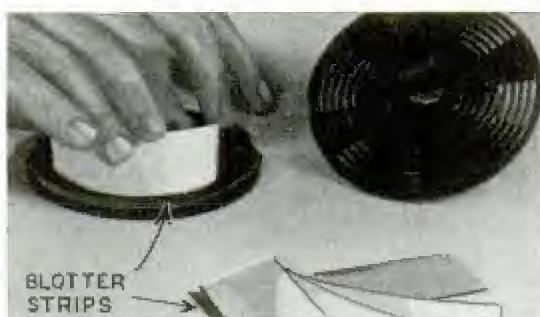
accurate. The filaments of the two lights are spaced exactly 1 in. apart. The distance between the streaks on the negative or print will then represent 1 in., no matter what the actual distance on the negative may be. This provides a unit with which to measure the length of the streaks and translate this into inches. The light closest to the turntable spindle, must be set so that its filament is spaced a known distance from the center of the spindle, say 6 in. This enables you to determine how far the light travels per second. Calculation of this is as follows: As the diameter of the circle made by the light revolving on the turntable is 12 in., its circumference would be 37.699 in., (diameter times 3.1416). With standard phonograph turntable speed of 78 r.p.m., the light would travel in a circu-

lar path a distance of 78 times 37.699 or 2,940 in. per minute. Then the distance covered in one second would be 2,940 divided by 60 or 49 in. In 1/10th sec. the distance covered would be 4.9 in. So with an accurate shutter set at 1/10th sec., the streak on the negative or print should be 4.9 times as long as the distance between the streaks, which represents 1 in. Any variation from this proportion would indicate a faulty shutter speed. For instance, if under the conditions just stated, the streaks are 25 percent longer than they should be, the shutter speed is 25 percent slower than its rated speed. Calculations can be simplified by making an enlarged print of the negative so that the two light streaks are exactly 1 in. apart. Then it will be unnecessary to figure the percentages, as you can take the actual measurements. The same procedure should be followed in making a test at every shutter speed.

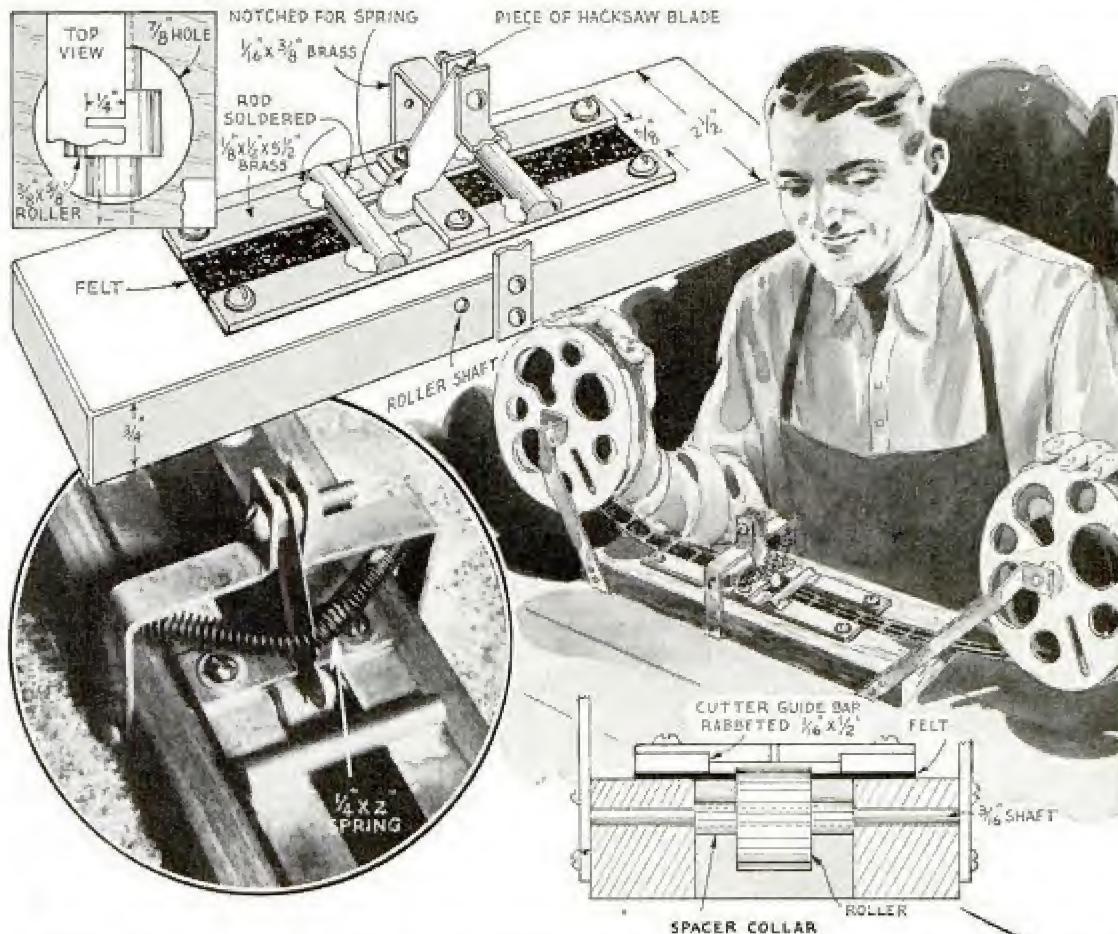
Blotting Paper Strips Dry Developing-Tank Reel Quickly

Strips of lintless blotting paper are handy and effective for drying the grooves of a developing-tank reel quickly. After wiping the reel as dry as possible with a cloth, run the blotter strips edgewise around the film track to pick up the remaining moisture. The strips can be dried and used repeatedly.

Dull spots on glossy prints will be unnoticed if covered with clear nail polish.



An Inexpensive Slitter for 16-mm. Movie Film



Anyone wishing to process his own 16-mm. motion-picture film and divide it to 8-mm. widths will find this slitter just the thing. It does not actually cut the film, but scores it so that it can be separated by creasing. The details show the construction. The base is bored for the insertion of a roller, as in the lower detail. This is located so that the slitting knife, made from a hacksaw blade, bears on top of it by

spring pressure as indicated in the lower left-hand detail. Brass strips spaced the width of the 16-mm. film are screwed to the base to provide a guide for the film, thin felt being placed between the guide and base to prevent scratching. A U-shaped bracket carries the knife, which rests in a notch on a guide bar screwed across the film guide. Two rods soldered across the latter help to prevent buckling of the film.

Household Bleach Removes Black Spots From Photo Prints

Black spots on photographic prints, resulting from pinholes in the negative, can be removed with any of the common household bleaches containing sodium hypochlorite. Pour a small amount of the bleach into a saucer and use a toothpick to apply it to the print. Touch the black spot very lightly with the end of the toothpick and blot immediately. Work very carefully, continuing the touching and blotting until the spot has been removed or has blended in with the surrounding area.



Photo Tray Balanced on Dowel Rocked by Touch of Finger



Rocking the developing tray will not become tiresome when making a large number of prints if you fasten a dowel to the

bottom as indicated. Use two pieces of adhesive tape to attach the dowel. If the tray is carefully balanced, a touch of the finger will cause it to rock for some time.

Marks on the Developer Bottle Show Condition of Solution

Time necessary for developing films in many fine-grain developers increases each time the developer is used. To keep an accurate record, make a small crayon mark on the developer bottle each time a roll is developed. The marks will indicate the necessary increase in time for the next roll.



WHAT KIND OF BOAT DO YOU WANT?

Whether it's a simple rowboat, an outboard runabout or a family cruiser, you'll find something you want among our plans. Build your boat now for the coming season



"Banta," 12-Ft. Runabout—1080-1081

"Banta," 12-Ft. Plywood Runabout—1080 and 1081: Simplified construction makes this plywood runabout easy to build. Here's the boat to take along on that weekend trip. 2 prints 50c.

"Falcon"—1070-1079 Incl.: Trim, sturdy 18-ft. in-board runabout or cabin cruiser. 66 in. beam, 42 in. total depth, 7 or 8 passengers. Makes a speed of about 17 m.p.h. with a 20 h.p. motor. 10 prints, material list and procedure \$2.50.

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"Sea Saucer"—893: Lightweight sailboat. Length 9½ ft. Planked with 3/16-in. plywood. 25c.

16-Ft. Canoe—811 and 812: Cedar planking covered with canvas. Two prints 50c.

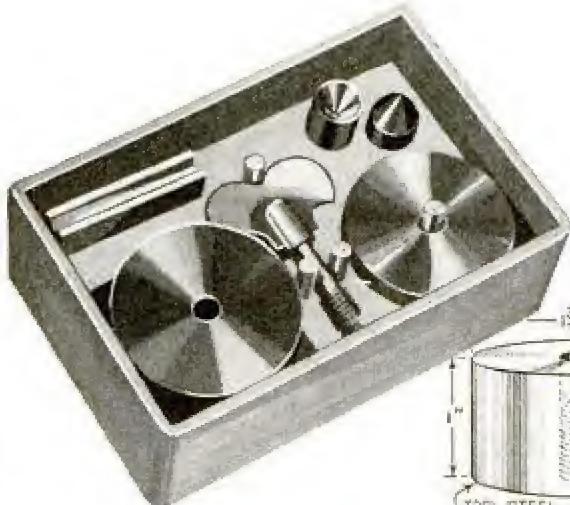
Canvas-Covered Kayak—928 and 929: Light framework covered with canvas. 17 ft. in length and accommodates single passenger. Two prints 50c.

7½-Ft. Plywood Rowboat—1068: Made from waterproof plywood this boat is easily transported on top of car. Complete instructions and material list included. 25c.

Address—Plan Service, Popular Mechanics Magazine, 200 E. Ontario St., Chicago



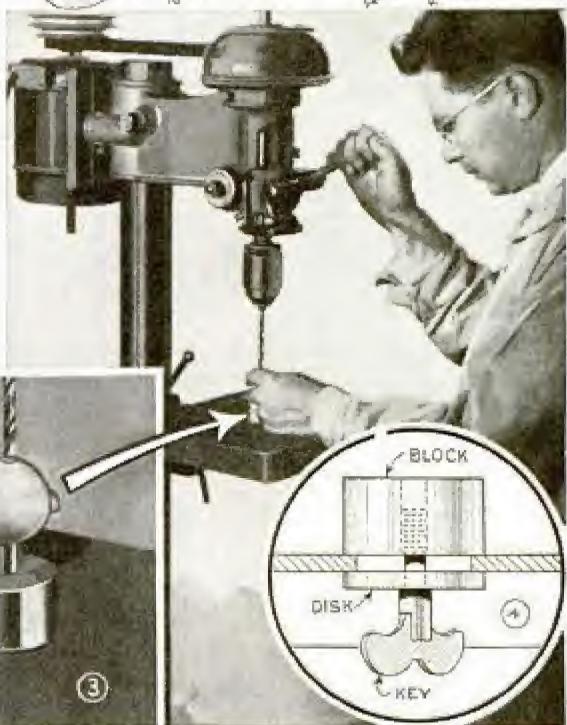
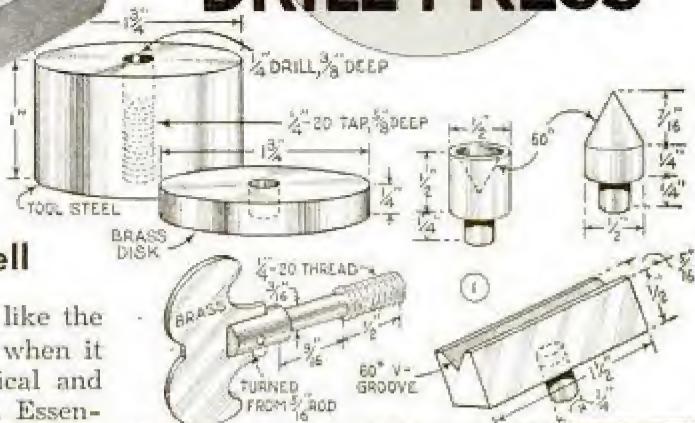
SHOP NOTES

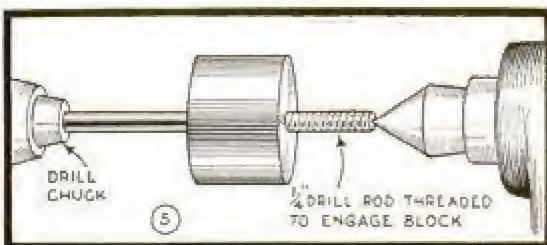
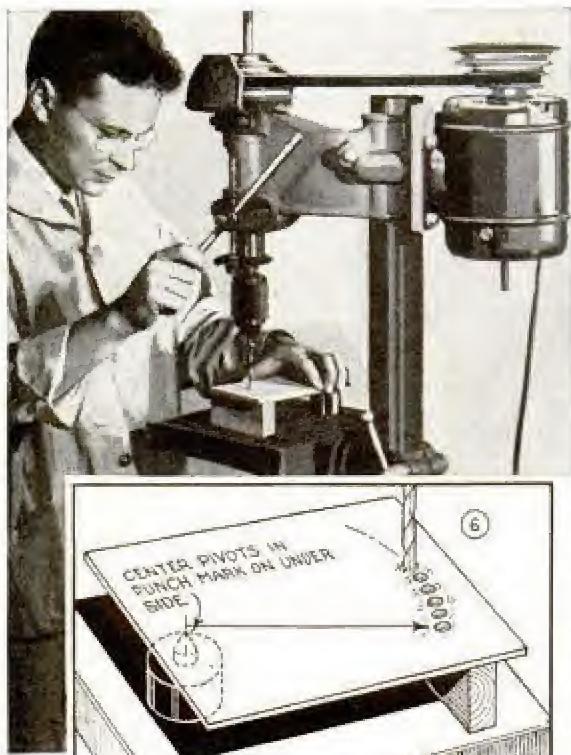


CENTERING FIXTURES *for the* DRILL PRESS

By Alexander Maxwell

YOU'LL find a set of centers like the one shown in Fig. 1 handy when it comes to holding small cylindrical and spherical-shape work for drilling. Essentially, the set consists of a central base having three interchangeable centers, namely: a vee, a cup, and a cone. The first is used to hold rod and tubular stock, and the second for spherical work as shown in Figs. 2 and 3 respectively. The cone center will be found useful in drill-cutting quadrants in heavy metal, and for roughing-out trunnion slots as shown in Fig. 6. Here the work pivots on the cone

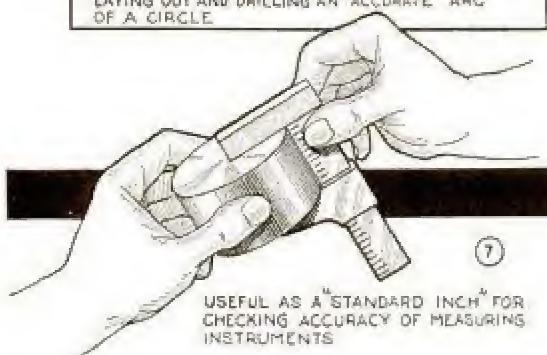




Then mount it between lathe centers as shown in Fig. 5, leaving the rod extending on each side just enough to permit surfacing the ends, yet to prevent chattering. Keep the tool very sharp, the work well oiled and take light cuts at high speed. If the block is to be used as a gauge to set dividers, calipers and other measuring instruments quickly as shown in Fig. 7, remove the last few thousandths of an inch with a toolpost grinder and check the work with a micrometer. In case a grinder is not available, a fairly accurate surface can be had by using a facing cutter and going over the surface three or four times after the final advance of the toolpost. The latter method will do where a critical caliper measurement makes little difference in the work involved.

Horseshoe Runners for Ice Sled

Needing a small sled to use about the buildings, one farmer made up a simple one and used discarded horseshoes for the runners. These were attached by means of small lag screws, the holes in the shoes being enlarged to take the screws.

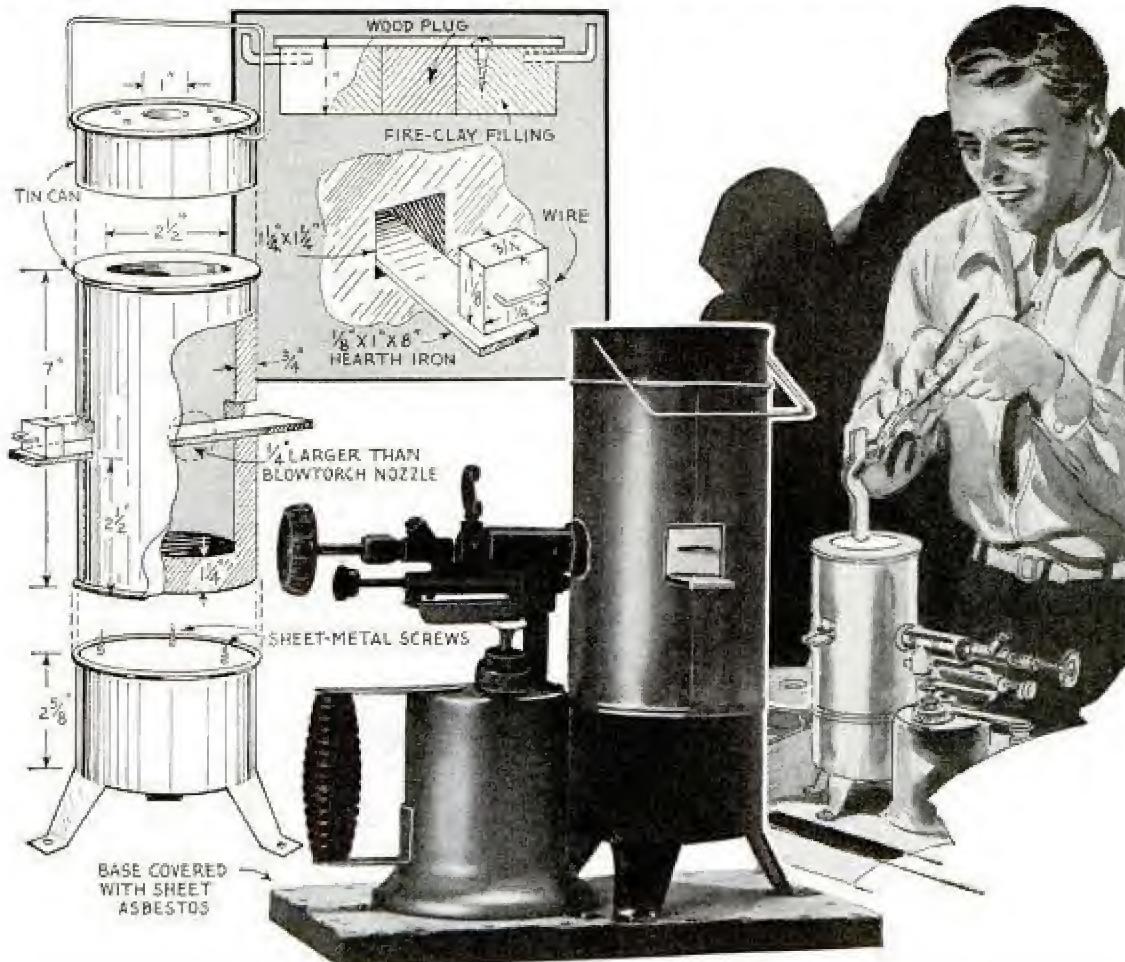


center located over one of the table slots. Fig. 4 shows how the key and washer of the set are used to clamp the base to the table, the key threading midway into the block to allow the tenoned centers to be inserted in the top. The work is centered accurately with the drill by loosening the key and shifting the base.

Unless the parts are to be subject to production work, they need not be hardened. To machine the base, first mount it in a four-jaw chuck and drill a No. 7 hole through it centrally. Counterbore the top of the hole $\frac{3}{8}$ in. deep and tap the bottom with a $\frac{1}{4}$ -20 thread to receive the key. Hold the tap in the tailstock chuck and rotate the work by hand. Now make a mandrel from a length of $\frac{1}{4}$ -in. drill rod and thread it part way to engage the block.



High-Temperature Furnace Has Tin-Can Shell



Providing sufficient heat for hardening, tempering and forging small work, this portable furnace uses a blowtorch to supply the heat, and three 4-in. dia. tin cans for the shell. The center can, which forms the heat chamber, has openings for a hearth iron and the torch nozzle, while the lower can is cut so that three legs are formed on the bottom. The cover has a 1-in. center opening and is fitted with a wire handle. Prepared stove lining is satisfactory for lining the furnace although fire clay is better. Before adding the lining, openings for the hearth iron, blow-

torch nozzle, etc., are fitted with soft-wood plugs, while a 2 1/2-in. mailing tube forms the core, after which the fireclay is tamped between it and the can. When the lining is almost dry, the furnace can be fired by cutting a hole in the paper core at the torch-nozzle opening. The torch is then set 1/4 in. from the opening and adjusted to burn with a low flame. After the paper core has burned and the lining is dry on the inner surface, the softwood plugs may be removed and the heat increased. If cracks develop in the lining, the surface should be thoroughly wetted and all cracks filled.

Small Rubber Bands and Washers Cut Quickly in Lathe

If you need a number of small rubber bands or washers that are difficult to obtain, try cutting them from a length of rubber tubing. The job can be done quickly in a lathe without any special equipment by merely slipping the tubing over a dowel

that is slightly larger than the inside diameter of the tubing. The dowel is then chucked in the lathe, and a sharp razor blade used to cut bands of any desired width. If a large quantity is to be cut, mount the razor blade in a sturdy holder.

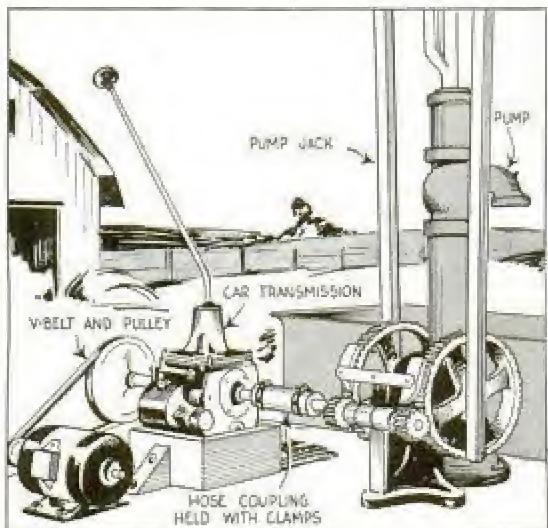
Dentist Cleans Spatula Quickly On Slotted Scraper



A piece of heavy sheet metal slotted and screwed to the underside of his bench provides one dentist with a good cleaner for his spatula. The spatula is cleaned by pulling it through the slot, the waste dropping into a can below the cleaner.

Three-Speed Pump Jack Controls Water Flow for Various Uses

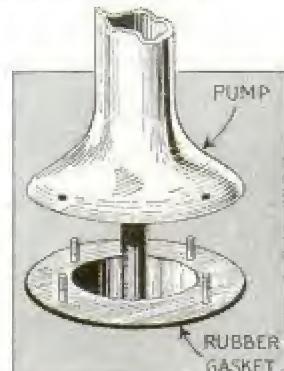
One farmer who wanted an easy method of controlling the speed of his well pump jack so that he could get different streams of water, did the job with an old auto transmission. This was belted to the motor and connected to the pump-jack shaft by



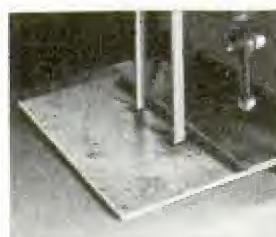
means of a hose coupling. Shifting gears of the transmission enabled him to fill the stock tank quickly, or provide a small stream of water for cooling milk.

Surface Water Kept From Well By Gasket Under Pump

Discovering that his well water was being contaminated by surface water, which was entering around the base of the pump, a farmer stopped the trouble by putting a rubber gasket under the base of the pump. This is a sure cure for this trouble unless the platform is cracked, or does not fit tightly on the well casing and allows the water to enter at these points.



Keeping Sawdust Out of a Motor



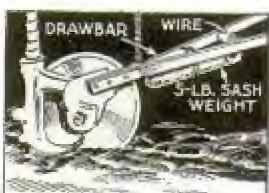
When a motor is mounted under a saw, sawdust can be kept from falling on top of it and eventually entering the housing if a shield is provided under the saw

blade. Location of the shield will be determined by the type of saw you have. In most cases, the shield can be made of sheet metal or hard-pressed board, which is fitted around the drive belt as indicated.

—Charles A. King, East Kingston, N. H.

Weighted Grain-Drill Openers Aid Work in Trashy Ground

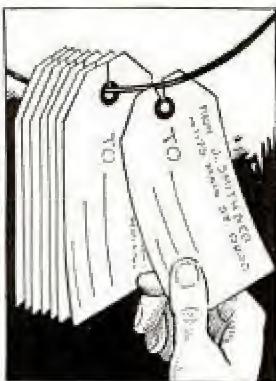
In trashy fields, corn roots, bunches of grass and weed stalks make it difficult to plant seed at a uniform depth with a grain drill equipped with disk openers of the type most commonly used. To provide the additional weight necessary to



cause the disks to cut through the greater part of the trash and deposit the seed at the proper depth, one farmer attached a 5-lb. sash weight to the drawbar of each opener. Under less trashy conditions and on certain types of drills, a 3-lb. weight is usually sufficient.

—W. C. Lammy, Naperville, Ill.

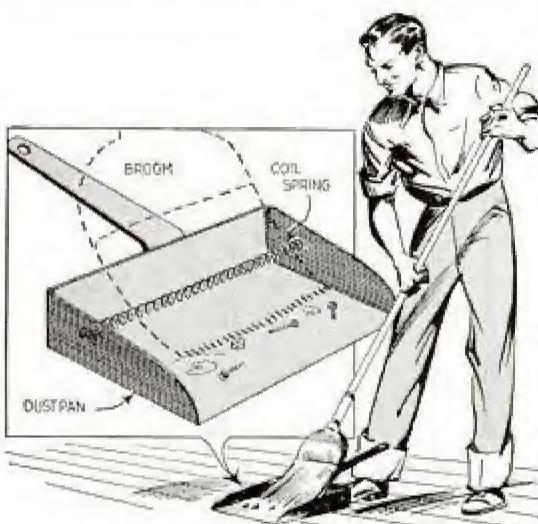
Prepared Shipping Tags Removed Easily From Closed Hoop



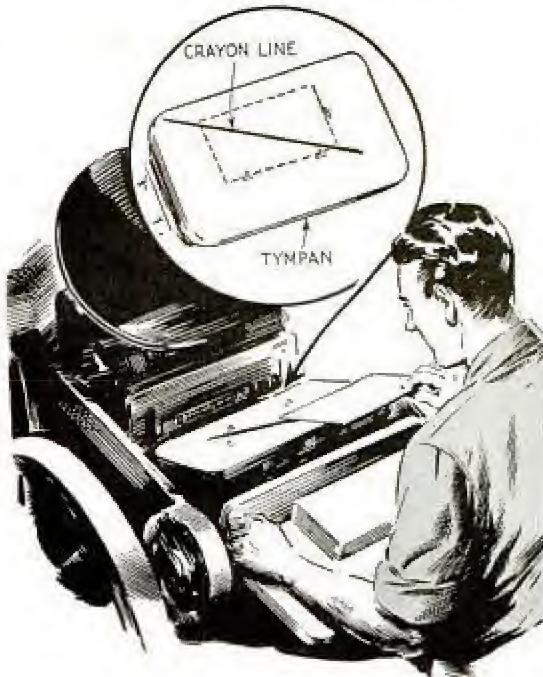
indicated. This can be done quickly if several of them are stacked at a time so that a stroke of a sharp knife or razor blade can be used to make the slit.

Coil Spring Across Dustpan Aids in Cleaning Broom

Bits of wire, steel shavings, etc., are easy to remove from a shop broom by using a coil spring stretched across the back of a dustpan. Pulling the bristles of the broom over the spring quickly dislodges any particles adhering to it.



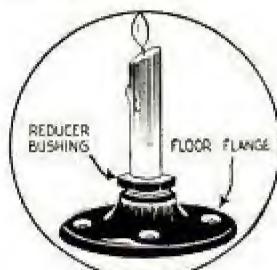
Colored Line on Tympan Sheet Simplifies Press Feeding



One shop foreman avoids fatigue when printing cards or envelopes at high speed on a platen press by using a colored crayon line drawn diagonally across the tympan sheet. The line directs the press feeder's eyes automatically so that his hand drops the card or envelope in place easily.

Floor Flange as Nontip Holder For Plumber's Candle

Plumbers who are sometimes forced to use a candle as illumination in places where an electric light is not available, will find that a floor flange provides a handy nontip holder for the candle. The opening in the flange can be reduced with bushings to fit the base of a candle.



Liquid asphalt compound used to repair roofs can be applied much easier and faster by using a discarded or cheap window squeegee instead of a tar brush. The liquid is poured in puddles here and there on the roof then spread neatly and evenly with a long handled squeegee.

X387A

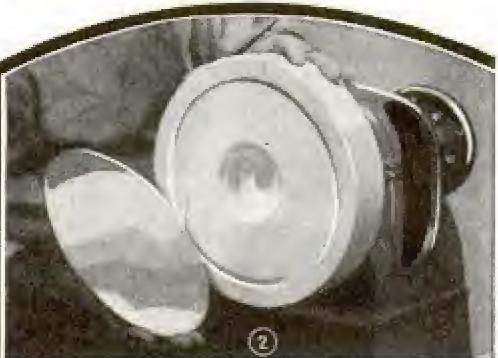
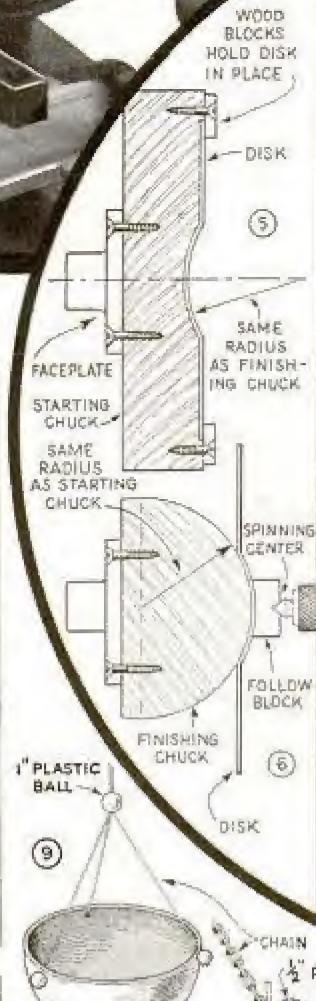
YOU CAN



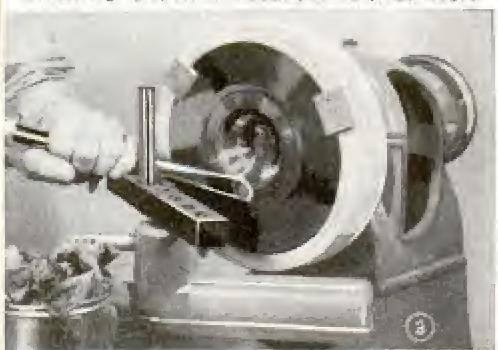
HANGING FLOWER BASKET



ASH TRAY



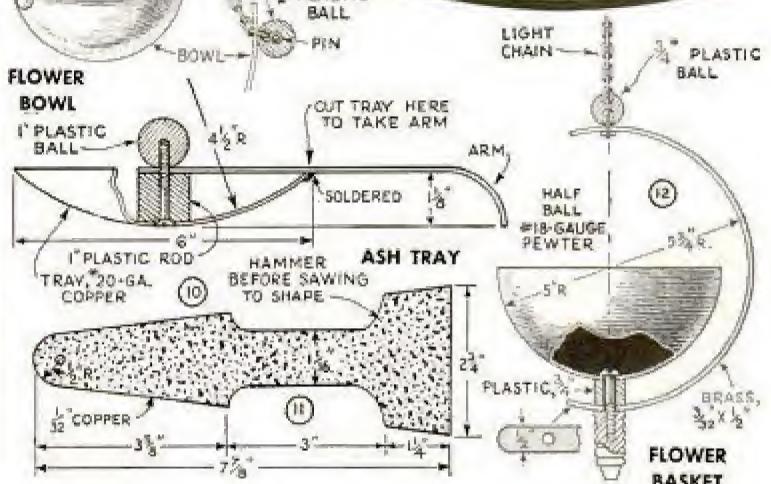
STARTING CHUCK IS RECESSED TO HOLD DISK



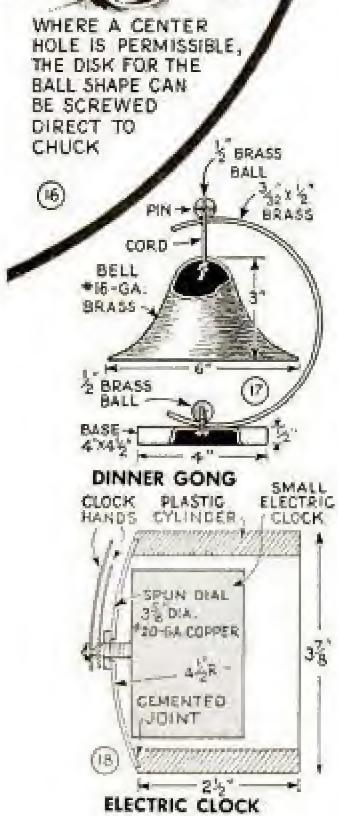
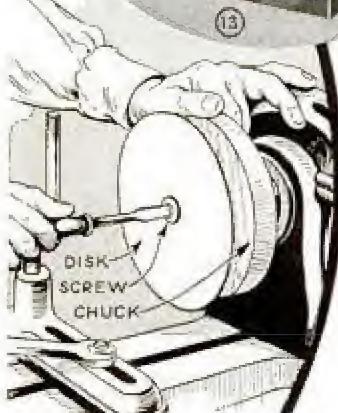
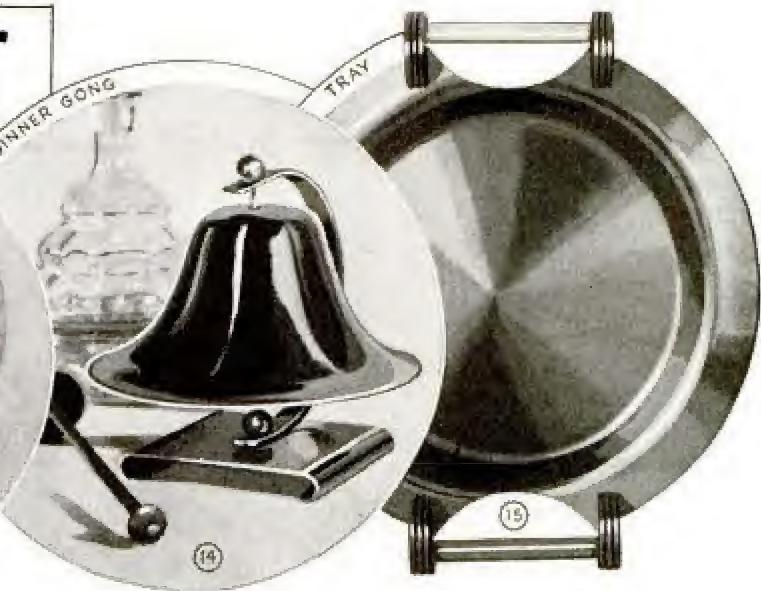
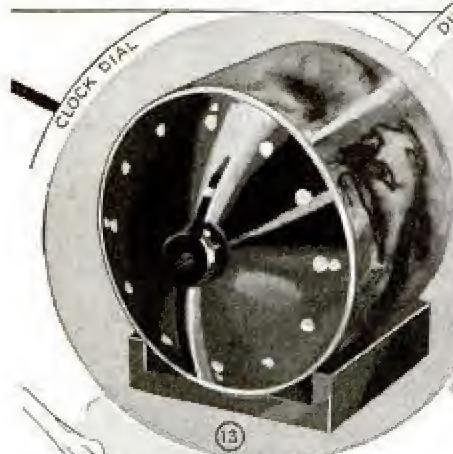
THE METAL DISK IS SPUN INTO THE RECESS



WORK IS FITTED TO EXTERNAL CHUCK TO FINISH



SPIN IT



Attractive and Useful Articles in Pewter and Copper That Anyone Can Spin on a Lathe

REQUIRING only a wood-turning lathe and a few added accessories, metal spinning opens a field of interesting, smart projects for the craftsman. Pewter of about 18 gauge should be the first choice of the beginner as it spins easily without annealing, and can be polished to a beautiful mirror finish.

The ball shape: A half ball of polished metal or a smaller portion of it has numerous applications. Typical is the flower bowl, Fig. 9, the hanging flower basket shown in Figs. 7 and 12, the ash tray, Figs. 8, 10 and 11, and the clock dial, Figs. 13 and 18. In many projects featuring this shape, a hole is required in the center of the metal. This is a fortunate feature as it permits the disk to be fastened directly to the chuck, Fig. 16, without the need of preliminary spinning on a starting chuck. Where the work has no center hole, the disk is started on a starting chuck, as in Figs. 2, 3, and 5. After the metal has been spun into the starting chuck, it is mounted on the finishing chuck to complete the spinning, Figs. 4 and 6.

The bell shape: This is very similar to the half-ball shape and requires a starting chuck unless the work specifies a center hole large enough to take a suitable screw. The dinner gong, Fig. 14, is an example of the bell shape. Fig. 17 shows the construction. This project uses a fairly heavy metal (16 gauge) in order to give a mellow tone to the bell when struck with a felt mallet.

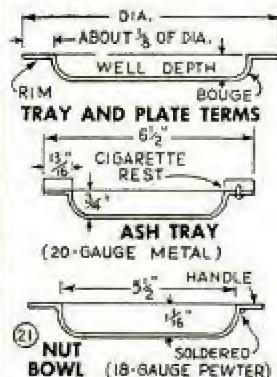
Shallow tray shape: The shallow tray or plate shape is probably featured more than any other in spun projects. The various terms applied to the tray shape are given at the top of Fig. 21, which also gives the dimensions of the ash tray and nut bowl shown in the photos, Figs. 19 and 20. This shape can be spun on either an internal or external chuck. An internal chuck indicates that the metal is to be spun into the chuck; an external chuck indicates that the metal is to be spun over the chuck. Fig. 22 shows an internal chuck with recessed rim to take a round metal blank. Fig. 23 shows the preferable method, using a square sheet



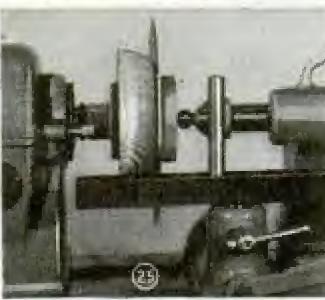
ASH TRAY



NUT BOWL



22



23



24



25



26



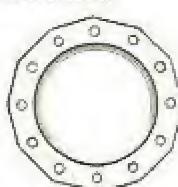
SPINNING SHALLOW TRAY
SHAPE ON EXTERNAL CHUCK

of metal screw-fastened to the sides of the chuck. The advantage of this mounting is that the face of the metal is completely clear. In any case, spinning is simply a matter of forcing the metal into the chuck shape, as shown in Fig. 24. The stroking action of the spinning tool should be from rim to center. Attention should be concentrated on getting the sharp turn at the rim down to the chuck surface. The rim will tend to lift during the spinning operation and should be hammered flat with a rawhide mallet.

In spinning the tray shape with the use of a standard external chuck, the metal disk is held in place by means of a follow block, which should be about $\frac{1}{8}$ in. less in diameter than the flat bottom of the tray. Pressure of the spinning center on the follow block holds the disk securely for spinning. The starting set-up is shown in Fig. 25. The spinning action is aimed at getting a small section of the metal down to the chuck sur-



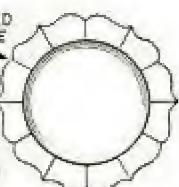
DECORATIVE
TREATMENT



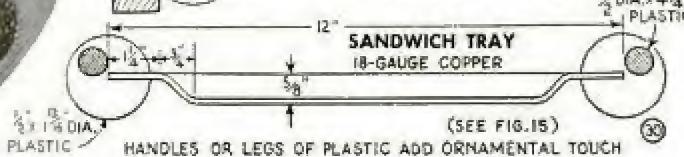
BEADS FORMED BY HAMMERING METAL INTO DEPRESSION IN HARDWOOD BLOCK

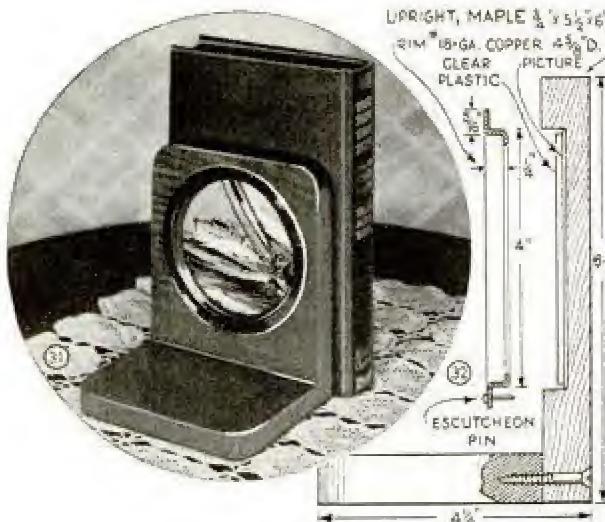


Scribed Lines Cut With Cut-off Tool, Filled With Paint, After Which Metal Is Sanded Clean



Divisions Set Off With Use Of Chisel Rounded At End To Dull Point





face while keeping the rest of the metal in a straight V-shape. The natural tendency of the metal to form a bell shape should be counteracted by stroking the metal not yet down to the chuck surface, at the same time, backing the spinning tool with a broomstick sharpened to a chisel point. The technique is shown in Fig. 1. After obtaining the V-shape in this manner, the flat tool takes another "bite" in forcing another short section of metal down to the chuck surface. Every time this is done the disk will start to "bell" and must be straightened to the required V-shape. After the metal is all down to the chuck surface, the rim can be trimmed, as shown in Fig. 26. The project shown as an example is the nut bowl, Fig. 20. This requires handles, which are soldered in place with pewter solder melted with a blow pipe, Fig. 27. Excessive heat must be avoided since the melting temperature of pewter is very close to the heat necessary to melt the special solder. Well done, soldered joints in pewter can be filed and polished to make a perfectly invisible joint.

Decorative treatment: Plates and trays can be decorated by hammering after spinning, Fig. 28, or by any of the simple methods shown in Fig. 29. The use of handles or legs of plastic adds an ornamental touch, as can be seen in the sandwich tray, Fig. 15. The dimensions of this tray are given in Fig. 30.

Metal-covered forms: In some projects, notably bases for lamps and candlesticks, the metal can be spun permanently over the chuck. This has an advantage in that narrow, neck shapes can be formed without resorting to complicated sectional

chucks. The base and top of the lamp stem shown in Fig. 33 illustrate the idea.

Metal rims: Metal rims for use on clocks, picture frames, etc., are spun easily by using the same technique as in spinning a shallow tray on an internal chuck. It can be seen that the rim used in the nautical book ends, Figs. 31 and 32, is simply a shallow tray with the center cut out.

General features of spinning: All chucks should be made from hard maple—the use of a softer wood will result in the grain of the wood printing on the metal. A good speed for all spinning operations is 1,000 r.p.m. The metal disk must be kept lubricated at all times. A half-and-half mixture of soft soap and soft grease is satisfactory. Although pewter is the most satisfactory, copper has excellent decorative value and is easy to spin as long as it remains soft. However, action of the spinning tool causes it to harden and become brittle. When this occurs, the metal blank should be removed from the lathe and annealed by heating over a gas ring to a dull red and then quenching in water. 20 gauge is a good all-around thickness for spun projects in copper. The same gauge in aluminum spins readily and has the advantage of requiring no annealing throughout the spinning process.

Don't use ordinary outside house paint on porch floors. It is not formulated for foot traffic. Apply one or two coats of porch and deck paint or porch and deck enamel.

Sandpaper Paddle Smooths Cloth On Steam Press



Smoothing the fabric of garments on his steam press without any possibility of burning his fingers, is a simple matter for one press operator, who uses a sandpaper paddle for the job. Use of the paddle also makes it unnecessary to touch the cloth, reducing the chances of getting finger marks on easily soiled garments.

Animals Can't Tip Feed Basket With Pitchfork Through Handle

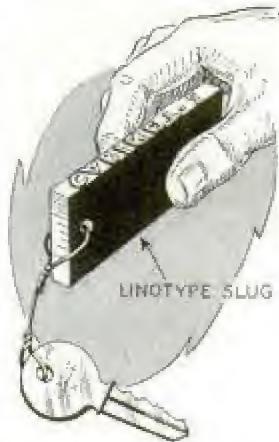
Animals which must be fed grain outdoors, can be prevented from tipping over the feed basket by using a pitchfork as



shown. The fork handle is run through one of the basket handles, after which the fork tines are pushed into the ground.

Individual Keys in Print Shop Marked by Linotype Slugs

By casting linotype slugs bearing the names of various rooms of a print shop, the proprietor made tags for the keys to the rooms. The heavy slugs also helped prevent any workman from inadvertently carrying a key away from the shop in his pocket.



Thimble Clip Helps Sign Writer Hold Brush Without Strain



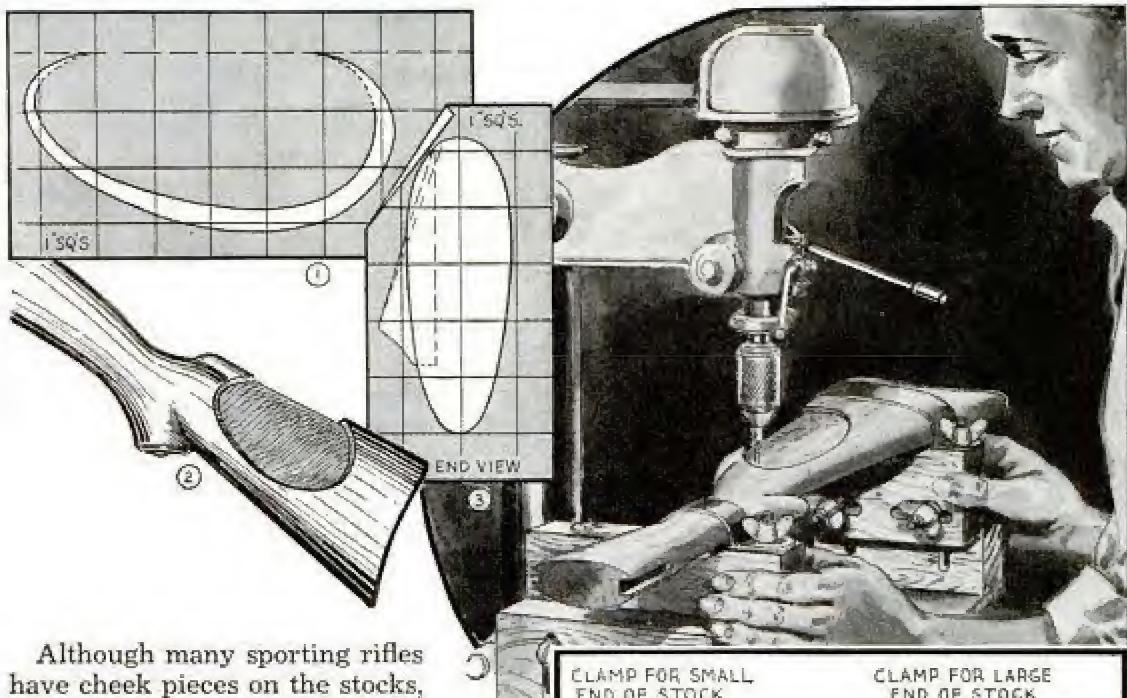
Sign and card writers who use a small brush for long periods of time will find that a clip soldered to a thimble will reduce finger strain. The clip is made to fit tightly around the handle of the brush and can be soldered to the side of the thimble at any angle suitable to the user.

Inverted Tumbler Used as Tray For Mixing Artists' Colors

When you need a small tray for mixing water colors, just invert a glass tumbler and mix the color in the concave bottom of the vessel. It is just about the right size for a small amount of color and it is easy to clean.

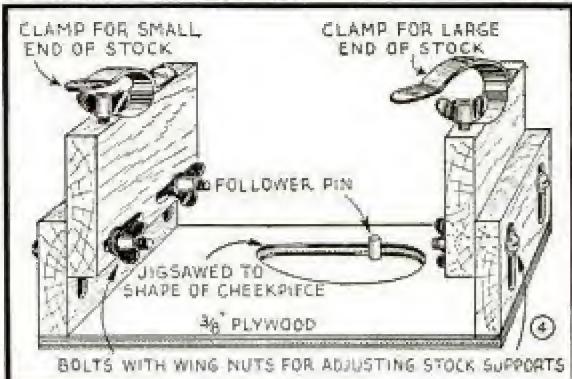


Inlaying a Cheek Piece in Your Own Gun Stock



Although many sporting rifles have cheek pieces on the stocks, most shotguns, except the highest priced ones, do not. However, any shotgun owner can make one for his stock. First, the stock must be routed out to form a cavity in which the piece is inlaid. A router bit in a drill press is ideal for this work. You will need a clamping jig like the one shown in Fig. 4 to hold the stock. Notice that the ends of the jig are adjustable in height so that the stock can be held level horizontally under the router bit.

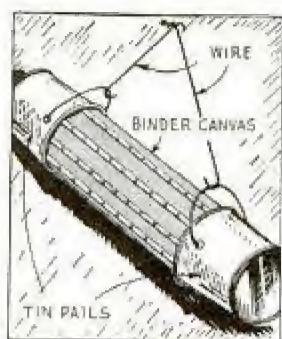
Also notice that the base of the jig is cut out exactly to the shape of the cheek-piece cavity to be routed in the stock. A pattern of this opening is given in the squared diagram of Fig. 1. The white portion indicates the amount of bevel on the edges of the cheek and has nothing to do with the shape of the opening. Just make this to the size and shape of the outside line of the pattern. In use, a pin is put in the drill-press table, and the jig is moved around to outline the cavity on the gun stock, keeping the edge of the opening in the jig against the pin. When the routing has been finished, make the cheek piece and inlay it in the cavity. Fig. 2 shows how the cavity appears on the average stock. The cheek piece is sawed to shape from 1-in. walnut, matching the stock as closely as possible in color and grain. Then it is glued in place, allowing



plenty of time to dry. After this, final shaping of the piece is done with a rasp, file and sandpaper, testing it frequently for fit. A general cross section of the piece in place is given in Fig. 3. The job is completed by finishing the work to match the stock.

Mice Kept Out of Binder Canvas

Slipped over the ends of a rolled binder canvas, two tin pails will prevent mice from entering. The canvas can be suspended from a ceiling with twine or wires attached to the bails.



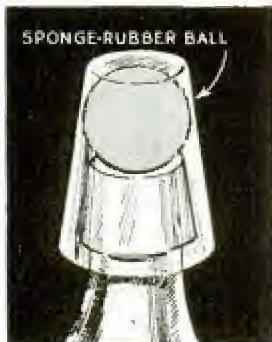
How to Avoid Drying of Paint In Wood-Finishing Shop



Having an occasional job of dip-painting small wooden objects in a trough, one manufacturer keeps his paint covered between batches in a large can. The bottom of the can and the bottom of the dipping trough are connected by means of a rubber hose. When the paint reservoir is raised, the paint runs into the trough. Then, when the reservoir is set on the floor, the paint runs from the trough back into it. With this method, filling or emptying the trough is just a matter of seconds.

—T. E. Stimson, Jr., Los Angeles, Calif.

Rubber Ball Serves as Stopper For Carboy of Acid



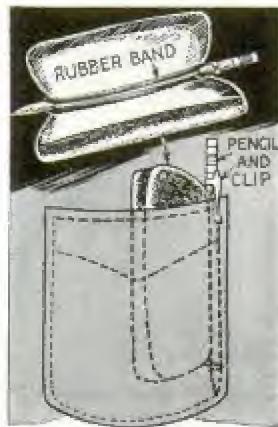
Removal of a tight-fitting stopper from a carboy of acid each time a little of the liquid was required was avoided by one dairyman who used a sponge-rubber ball as a stopper. This was pressed inside a glass tumbler and inverted over the mouth of the carboy as indicated. The tumbler provided weight so that the ball sealed the

glass tumbler and inverted over the mouth of the carboy as indicated. The tumbler provided weight so that the ball sealed the

carboy, and permitted the ball to be lifted without getting acid on the hands. Also, the tumbler prevents the stopper from being knocked off the carboy accidentally.

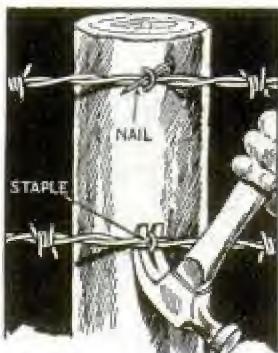
Spectacle Case Held in Pocket By Pencil and Rubber Band

As a safeguard against losing his spectacle case while working, one carpenter fastens it to his pencil with a rubber band. The pencil is first placed against the case as shown, after which the band is stretched inside the lid and slipped over both ends of the pencil. The clip holds both pencil and case securely in the pocket.



Nail-and-Staple Wire Fasteners On Temporary Stock Fence

If you want to put up a temporary fence that can be taken down quickly, slip a nail in each staple before driving it home as indicated. When the fence has served its purpose, just pull the nails to loosen the wire, which will provide enough space so that a claw hammer can be inserted behind the wire and pull the staples.—A. H. Waychoff, Phoenix, Arizona.



Sharp Tool for Marking Metal

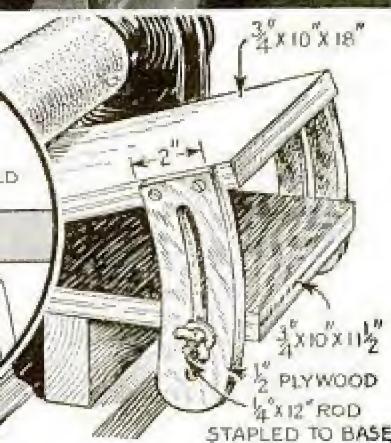
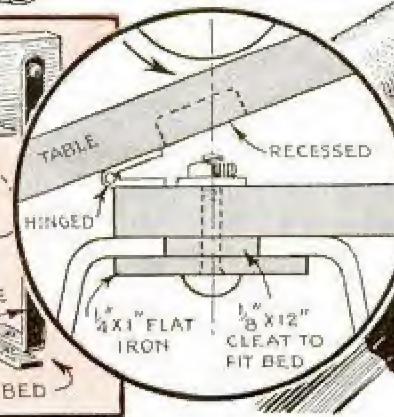
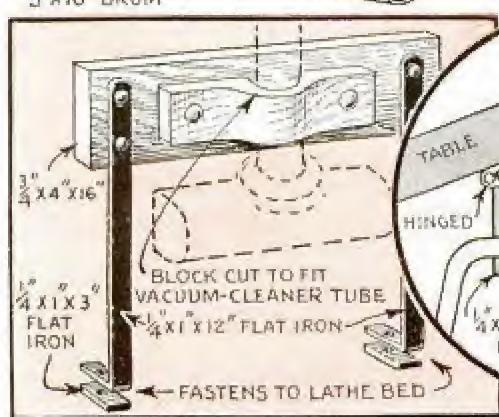
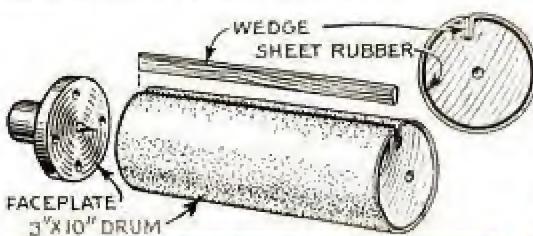
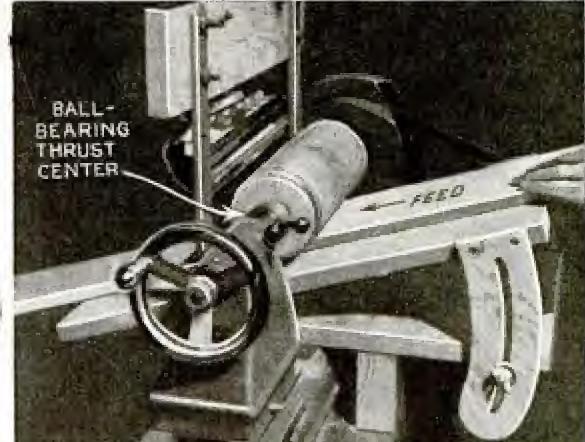
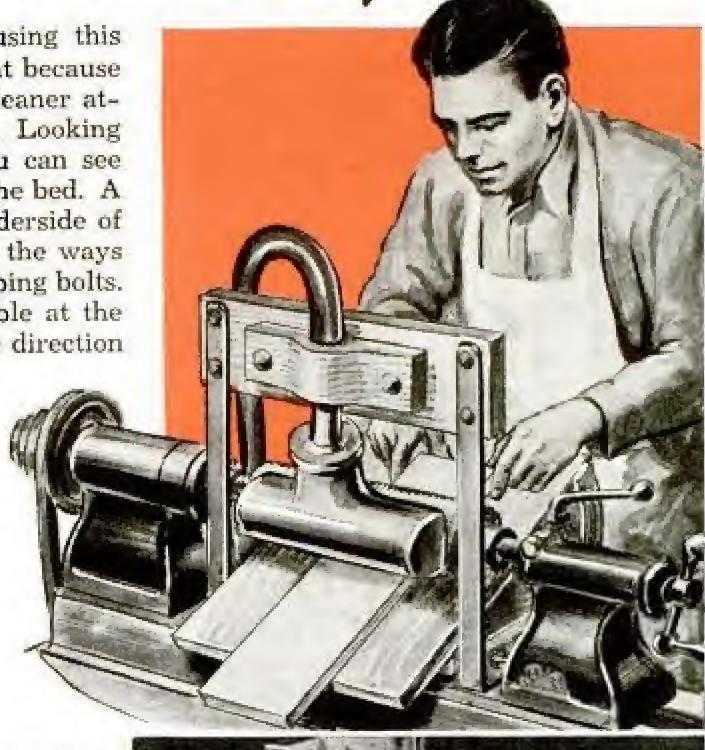
Where exact dimensions must be followed, a sharp tool for marking and laying out metal work can be made in a few minutes by filing off the point of a large nail and drilling a hole in the end of it for a phonograph needle. The needle is either soldered or driven in place so that the point projects about $\frac{1}{8}$ in.

—Ward Williams, Brandon, Wis.

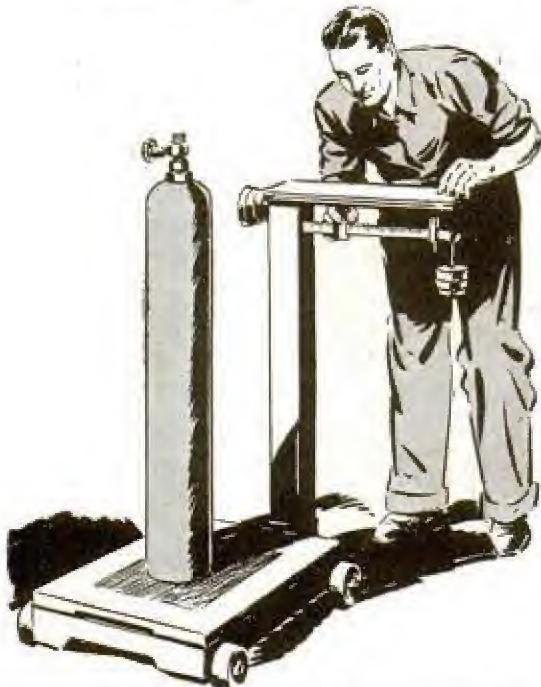
THICKNESS SANDER ON LATHE

has suction dust disposal

DUST is no problem when using this thickness-sanding attachment because it is disposed of by a vacuum-cleaner attachment as shown at the right. Looking at the circular detail below you can see how the sander clamps to the lathe bed. A wood cleat is screwed to the underside of the base to align the table with the ways and it is drilled to take two clamping bolts. It is important to mount the table at the rear side of the lathe so that the direction of rotation is against the direction of feed. The bracket supporting the suction spout must be made to fit the attachment at hand. After making sure that the drum is the same diameter its full length, it is slotted for a paper-locking wedge and covered with rubber. A ball-thrust bearing is used to support the drum at the tailstock, otherwise the center will wear an enlarged hole, eventually causing the drum to cut unevenly. Table trunnions riding the threaded ends of a rod stapled to the underside of the base regulate the depth of cut. While the size of the lathe governs the capacity of the sander, the one shown in the photo will handle stock up to 1½ in. thick.



Weighing Drum of Chlorine Gas Determines Amount Left



In order to determine the amount of gas remaining in a drum of chlorine gas, I used the following method: I weighed the drum and then subtracted the weight of the drum itself. This gave me the weight of the gas in the drum. Knowing the total weight of a filled drum, it was easy to determine approximately the amount of gas left.—Elmer Kling, Norwalk, Conn.

Pail Elevates Poultry Feed Pan



BOTTOMLESS PAIL
fit down into it as indicated to keep it from being knocked off.

Printing on Small Brass Strips

Receiving an order for some business cards to be printed on brass, we did the job as follows: The type was first set up

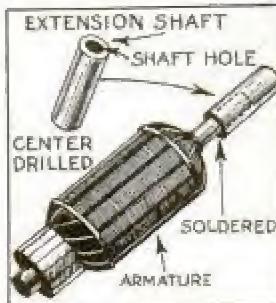
and a rubber stamp made of it, after which the stamp was locked in a chase for the press. After the pieces were all printed, the ink was baked on by holding the brass pieces over a flame.

—W. F. Hagerman, Quincy, Ill.

Extension on an Armature Shaft Fitted With Aid of Solder

When fitting an extension on the armature shaft of a small motor, I found it almost impossible to get a pressed fit by drilling the hole in the extension with a regular drill because it bores a few thousandths oversize. To overcome this, I flowed solder on the extension shaft to enlarge it. This was then pressed on, forming a tight fit which held satisfactorily.

—Warren Taliaferro, Dallas, Tex.



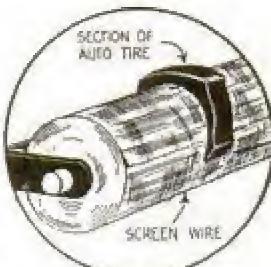
Pin Tags Provide Finger Tabs To Remove Box Covers



Avoiding the annoyance of prying tight covers from cardboard boxes in a store, a clerk attaches pin-type price tags to the covers as shown. The tags provide good finger grips.

Rolls of Screen Wire "Tied" With Tire Sections

One hardware dealer keeps screen wire from unrolling over his workbench by using narrow sections of old auto tire. These are slipped over a roll in a jiffy as indicated, and they automatically adjust themselves to rolls of wire of different sizes.



By C. E. Packer

WHEN a starting motor fails to crank the car engine properly, the trouble will most commonly be found not in the motor itself, but in the starter gear, or in the external circuits. If closing the starter switch puts the lights out, and releasing it causes them to come on again, the fault is likely to be a corroded or loose connection at the battery. You can tell by closing the switch for 20 sec. and then feeling the battery terminals. The faulty one will be very warm. The cure is to remove the terminal, scrape it bright and coat it with vaseline. If the lights merely dim when the switch is closed and brighten after release, the battery usually will be found partially discharged or in poor condition. But, should pressing the starter switch have no effect on the lights, there is an open circuit in the wiring.

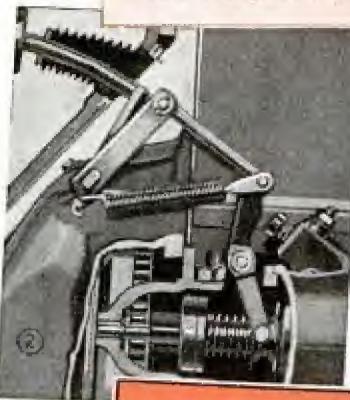
However, if pressing the starter switch has little effect on the lights and results in a decided whirring sound, it indicates that the starter gear is not meshing with the flywheel ring gear. In cars with a starter gear as in Fig. 1, the cure is to wash the gear and shaft in kerosene and dry it with air. Use no oil on this. While inspecting, it is well to see that the little spring-actuated pin, indicated by the screwdriver, is not stuck behind the shoulder on the shaft as this would prevent engagement.

Failure to engage in any starter that has a lever extending down into the starter housing as in Fig. 2 indicates a broken engaging spring, seen in Fig. 3. In this type of starter, the pinion is shifted against the teeth of the flywheel under spring tension resulting from the movement of the engaging lever against the spring collar. As the downward movement of the starter pedal continues the lever finally closes the starter switch. If engagement had been delayed due to gear teeth meeting on edge,

Shooting AUTO-STARTER TROUBLES



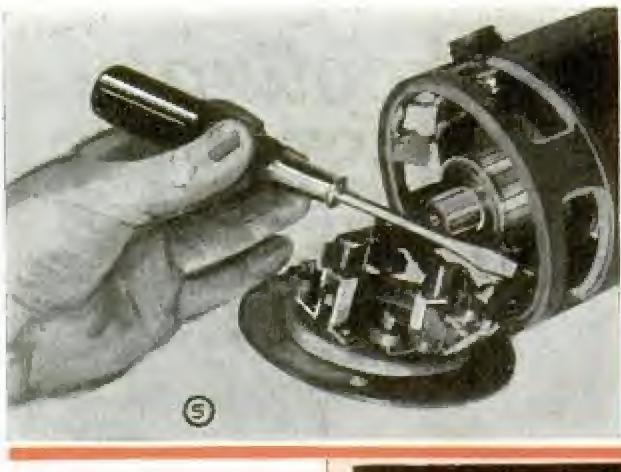
When inspecting a starter-gear mechanism, always be sure the little spring-actuated pin, shown above, is not stuck behind the shoulder on the shaft as this would prevent engagement of the gear with the gear on flywheel



Failure of gear engagement in any starter that has a lever extending down into the starter housing as at the left, indicates a broken engaging spring as shown below. In this type, the pinion is shifted against the teeth of the flywheel under spring tension which results from the movement of the engaging lever against the spring collar. As the lever continues forward the starter switch is closed



(4)



5

the first movement of the starter shaft would allow the pinion under its spring tension to slip into engagement.

When the car engine starts, the starting motors are protected by two actions. In the construction shown in Fig. 1 the pinion is whirled out of engagement by the spiral shaft. In Fig. 2 there is an overrunning clutch immediately behind the pinion that acts like a coaster brake in a bicycle. Thus when the flywheel attempts to whirl the starter it merely spins the pinion until the driver lifts his foot and disengages it. Failure of the starter to make any effort to turn is frequently due to a bad contact within the switch. Removing the switch and filing the contact, as shown in Fig. 4, will generally correct such condition.

Should dimming of the lights result when the starter button is pressed and the battery is known to be fully charged, the trouble is likely caused by excessively heavy oil on a very cold day, mechanical jamming of the starter drive so that the starter

cannot turn, or a ground or short within the starter or switch. A short or ground will generally reveal its location by smoking when the switch is held down for 20 sec. Trouble within the starter generally can be located by visual inspection. Fig. 5 indicates a charred brush lead that was grounded by being squeezed under the commutator cover. Look at all insulation for charred conditions that would indicate "shorts" or grounds. A test light should be used to check the armature, field and brush ring for grounds also.

It is not unusual for starters to be very weak and to draw too little current. This is commonly due to worn brushes, worn and burned commutator, and too weak brush springs. When turning down a commutator in the lathe it is not necessary or desirable to undercut the mica between the commutator segments indicated by the pencil in Fig. 6. If this mica is undercut the brush dust may accumulate and cause partial shorts between segments, the centrifugal force being insufficient to expel it as on generators.

Probably most common starter trouble is worn brushes. And when replacing brushes don't check for size alone. Be sure that the replacement brush is a real starter brush, not a generator brush. Generator



6

Mica on a starter commutator is not usually undercut as dust would collect in the grooves and cause short-circuits

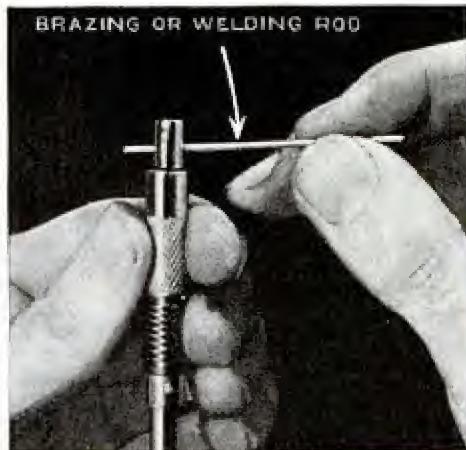


7

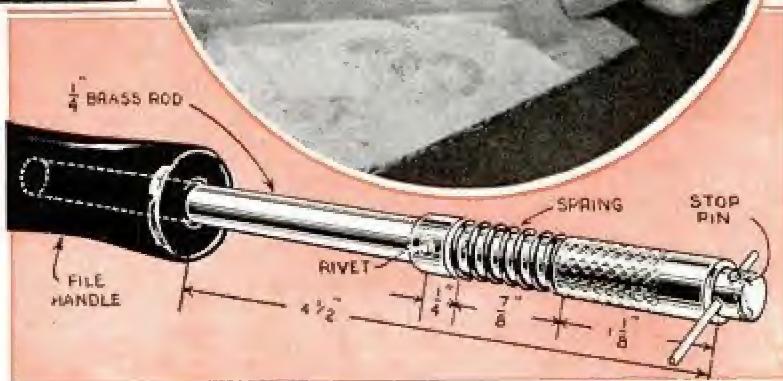
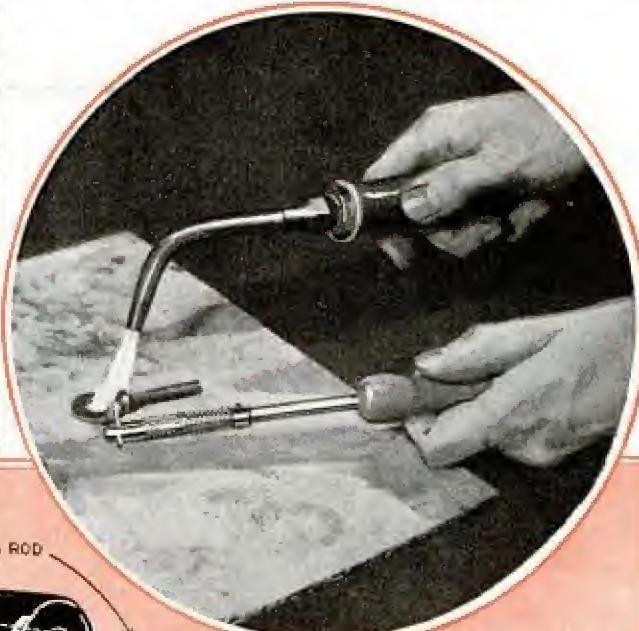
Be sure new brushes are made for a starter; not a generator. Starter brushes show a coppery color when scraped

brushes are primarily carbon and have relatively high resistance. Starter brushes, however, contain a high percentage of copper or bronze, and when they are scraped lightly with a screwdriver, as shown in Fig. 7, they will show a coppery color.

Holder to Use Short Lengths of Welding Rods



You can save money with this holder because you can use all but about $\frac{1}{2}$ in. of each welding rod. The holder is made of brass, and consists of a rod on which a spring forces a sleeve against the welding rod to hold it in place. A stop pin prevents the sleeve from sliding too far when the work is removed. A wooden file handle provides a good grip for the hand when using the holder close to the torch.

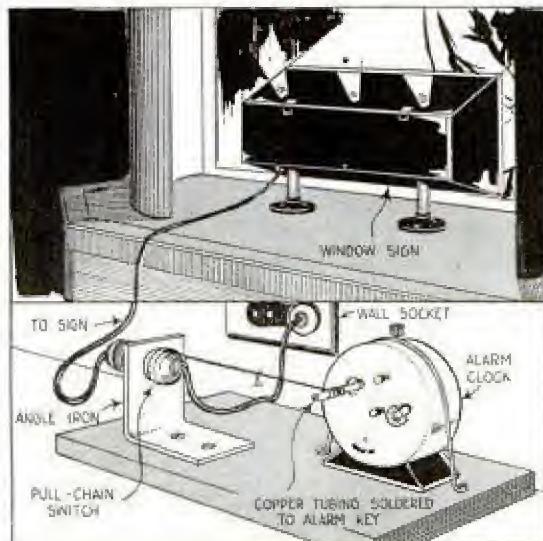


Simple Time Switch to Control Electrical Appliances

Using an alarm clock and a pull-chain lamp socket, or switch, anyone can make a time switch that will open or close an electrical circuit at a predetermined time. The socket is mounted on a bracket of angle iron, which is screwed to a base. The clock is mounted on the same base, and has

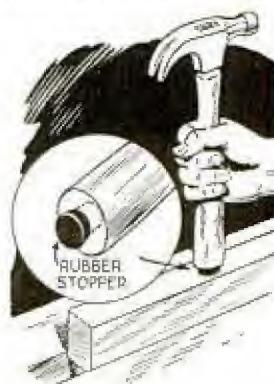
a short piece of copper tubing soldered to the alarm-winding key. String wound around this tubing is tied to the pull chain of the socket. In this way, the string winds up on the tubing when the clock alarm goes off, and pulls the chain, closing or opening the circuit, whichever is desired.

—R. V. Banks, Brooklyn, N. Y.



Rubber Plug in Hammer Handle Handy to Tap Work Into Place

You will always have a soft-nosed "mallet" for tapping sanded or planed work into place if you drill a hole in the end of your hammer handle and fit a rubber stopper into it. The stopper should project about $\frac{1}{4}$ in.



Colored Celluloid Softens Glare Of Instrument-Panel Lights

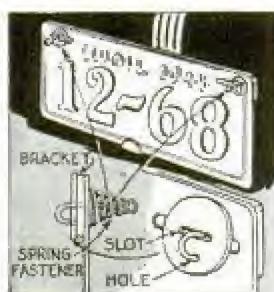


If you have an older car that is not provided with a dimming switch on the instrument-panel lights, and the glare from these lights bothers you on night drives, the glare can be eliminated by putting a piece of colored celluloid over the panel. A couple of small vacuum cups fastened to the celluloid will hold it in place.

Milk Bottle Tests Car Brakes

You can determine whether your car brakes are reasonably safe for moderate driving by making a simple test with a milk bottle. Just pour a pint of water in a quart bottle, cap it and set it on the car floor. Next select a level road or street and drive the car at 20 m.p.h. and apply the brakes. If the bottle does not upset, the brakes will not pass official inspection.

Quick-Change Spring Fasteners For Dealers' License Plates

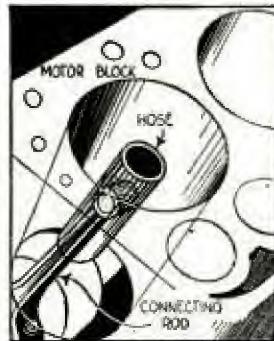


It takes only a few seconds to change a set of plates from one car to another when fasteners of the type shown are used. The set consists of four ordinary winter-

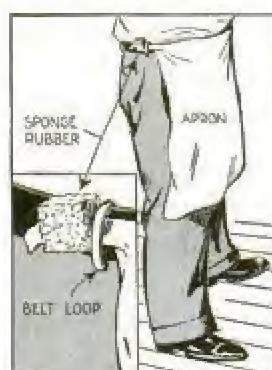
front fasteners, to which are added sheet-metal washers having slots in the center and a small hole to lock the hooks in place.

Scratching of Cylinder Avoided While Fitting Bearing

Any possibility of scratching a cylinder wall while fitting a connecting-rod bearing with the piston removed, is avoided by shielding the end of the rod. A short length of radiator hose is ideal for this purpose when slipped over the wrist-pin end of the connecting rod, as shown.



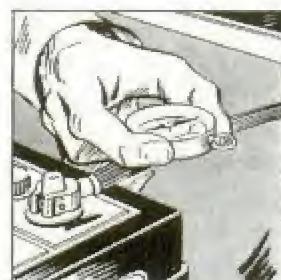
Mechanic's Apron Held in Place With Sponge-Rubber "Buttons"



To avoid loss of time in tying and untying the strings of his work apron, one mechanic uses sponge-rubber "buttons" to fasten it in his trouser belt loops. After cutting off the apron strings, leaving each one about an inch long, he slit squares of sponge rubber to slip over them and stitched the rubber in place as shown.

Slight Electrical Leaks in Car Determined by Compass

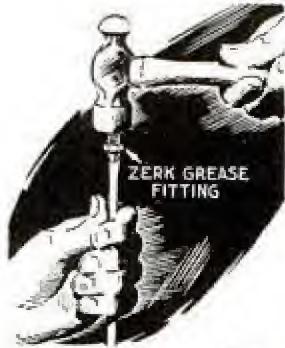
Sometimes in older model cars there is an electrical leak, not bad enough to blow a fuse, but enough to run down a battery over the weekend. If such a leak is suspected, you can make sure with a compass. After turning off all switches in the elec-



trical circuit, place the compass on the heavy cable going from the battery to the starter switch. If there is the slightest amount of current passing along the cable, the compass needle will be deflected from normal position.

—Guy E. McAllan, Fernie, B. C., Can.

Flaring Tool for Copper Tubing From Zerk Grease Fitting



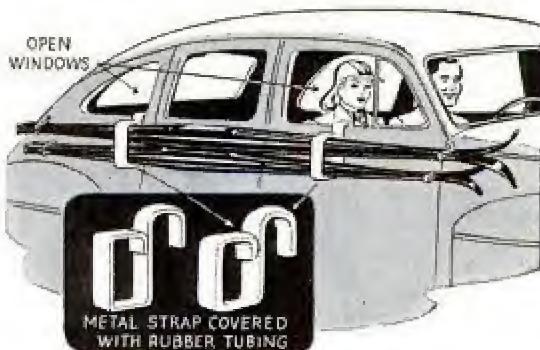
The next time you want to flare the end of a copper or brass tube and have no tool at hand for the purpose, just use a zerk grease fitting. The taper on the end of the fitting is just about right to make the flare

if it is tapped lightly into the end of the tube. If a loose fitting isn't at hand, take one off the car and replace it when the job is finished. When using a fitting taken from the car, be especially careful not to damage either the threads or the end that takes the grease gun.

—Emil J. Novak, Omaha, Nebr.

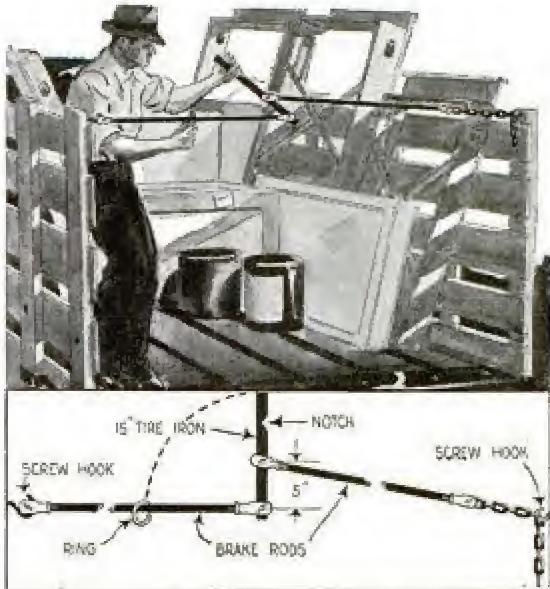
Inexpensive Car-Side Ski Rack Of Bent Flat Iron

Useful for carrying skis, fishing poles, etc., on the side of your car without marring the finish, this simple rack is nothing



more than a couple of pieces of flat iron bent to the shape indicated and covered with rubber tubing. Allowance for the tubing should be made before bending the pieces as each hanger should be a snug fit over the window opening.

Anti-Spread "Chain" for Truck Utilizes Old Brake Rods



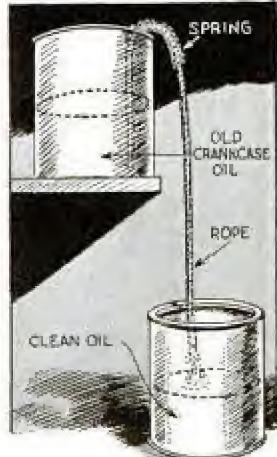
A tire iron and a couple of brake rods with clevises provide a handy anti-spread chain for truck bodies when assembled as shown. Two lengths of chain at the ends permit quick adjustment for width. A notch in the tire iron slips into a ring on one of the rods when the iron is pulled down to tighten the assembly.

—Frank Petrucci, Hazleton, Pa.

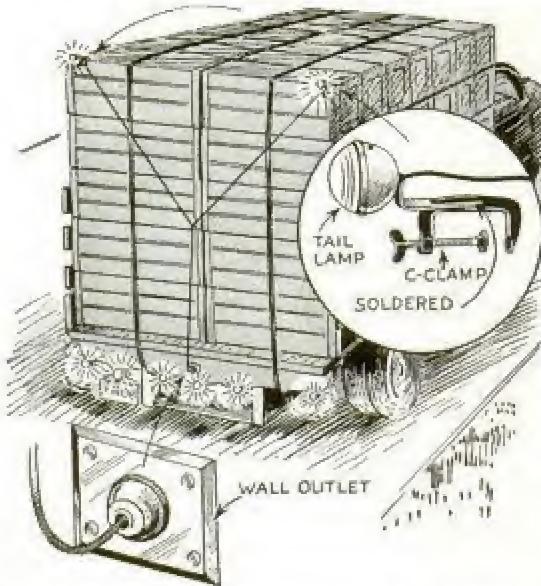
Reclaiming Used Motor Oil

Here is the way I reclaim old motor oil for other uses, and it comes out clear and free of carbon or other foreign particles. Just put the used oil in a container on a shelf, box or table. Then hang a rope over the edge of the container with one end in the oil and the other in a second container underneath. A spring or coiled wire over the rope where it contacts the edge of the upper container will keep it in place. Capillary attraction will cause the oil to rise in the rope and run down into the lower container.

—C. Champion, Birmingham, Mich.



Removable Clearance Lights For Platform Truck



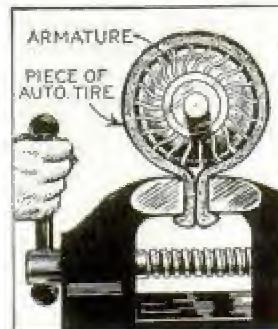
As a sufficient number of clearance lights are very essential, especially on foggy nights, the problem of attaching them in the right locations to a high load on a platform-type truck was solved by one driver who attached them to C-clamps as shown in the circular detail. With this method, the lights can be attached at convenient

positions on the load, and quickly removed when necessary. The lamps are all wired into one individual line in such a manner that they can be plugged into an ordinary wall outlet located within easy reach at the rear of a truck. All wiring must be done carefully, of course, to avoid short-circuits, and rubber-covered wire that is weather-proof should be used.

—John Blackburn, Oakland City, Ind.

Motor Armatures Gripped in Vise By Using Piece of Auto Tire

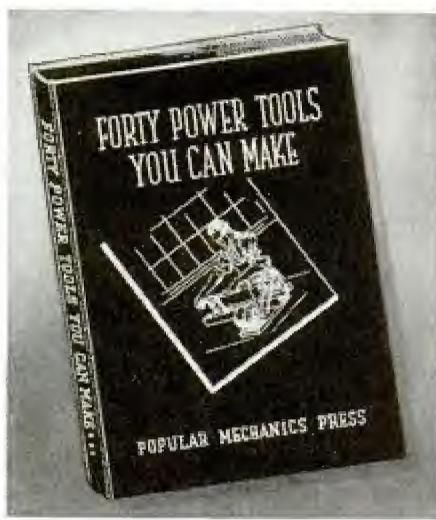
It is poor practice to clamp an armature directly in the jaws of a vise, even if padding of some kind is used, as there is always the possibility of damaging the laminations or the winding. A better method is to use a section of old auto tire, clamping the tire around the armature and then clamping the beads of the tire in the jaws of the vise.—Emil J. Novak, Omaha, Nebr.



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Do you want a motorized workshop that is inexpensive, will speed up your work and do it accurately? Then don't fail to get this amazing book! It shows every detail and explains in non-technical style just how to go about making forty different machines. The material used to build them is available almost anywhere—standard iron and brass stock, wood, pipe, old auto parts, etc., which can be picked up for almost nothing. If you want to earn extra money by making things in your spare time

to sell, you'll need to employ fast production methods only possible with motorized equipment. Building just one of the tools described in this book will pay for it many times. Send for your copy now and start making the machine you want.



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Disk Sander	Filing Machine
Belt Sander	Milling Unit
Drum Sander	Abrasive Cut-off Wheel

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TELEVISION

for the home

THIS low console television receiver provides a comfortable method of viewing the picture in the home, being designed in such a manner that the screen is actually aimed at the viewer. It is 38½ in. high, 21 in. wide and 25¾ in. in depth. Completely a.c. operated from standard 110-volt 60-cycle power lines, it employs 22 tubes including the Du Mont "Teletron," a cathode-ray tube developed for brilliant, large-image television reception. A dynamic speaker is used for sound reproduction and the picture measures a full 8 inches by 10 inches and is viewed directly from the screen of the "Teletron" tube as indicated in photo A.

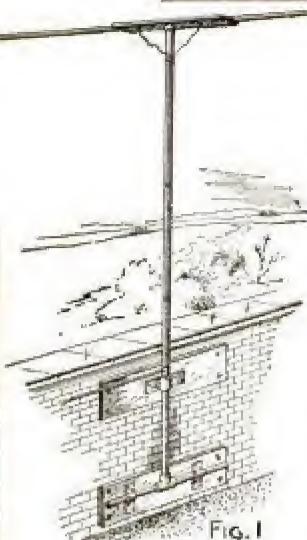
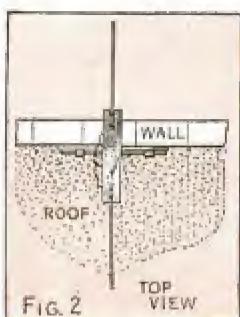
The various operating controls are conveniently arranged on the front of the receiver as shown in photo B. Although television programs are available only in the immedi-



ate vicinity of a few large cities at the present time, it is estimated that there are probably more than 3,000 television receivers operating in and around New York City. One owner says, "You relax in the comfort of your own living room and a varied television program appears on the screen of your receiver. First you see the news of the day, perhaps at the time it actually occurs, then a

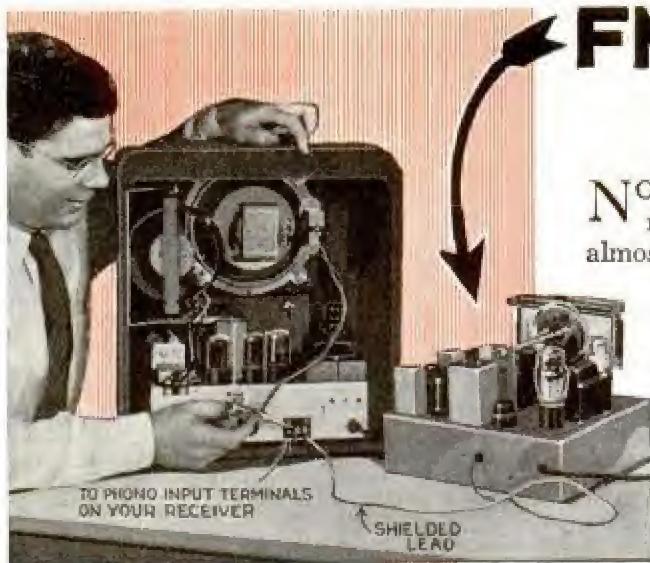
drama created and sent through the air directly from the studio. The pictures are clear, crisp, brilliant and of good contrast. So perfect, in fact, you recall, that during the program you might have thought yourself at the theater. Sports of every description may come to you as they happen in this new era of home television entertainment."

The dipole form of directional antenna shown in Figs. 1 and 2, is generally satisfactory. It consists of two metal rods, each approximately 5 ft. long and placed on a line with each other. If signal level is low due to local conditions, a reflector consisting of a rod about 10 ft. long is placed parallel with the dipole, about 5 ft. back of it.



FM ADAPTER

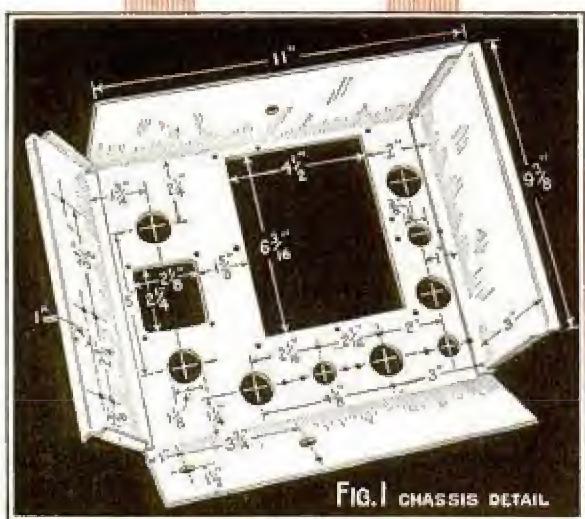
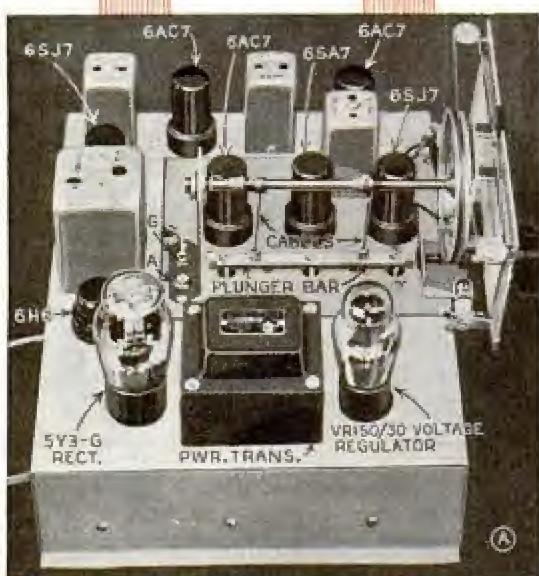
By L. M. Dezettel



NOW that Frequency Modulation transmitters have brought the high quality, almost noise-free "FM" programs within listening distance of an estimated 38,000,000 people, there is a constant demand for practical information on this fundamentally different type of broadcasting. The only portion of your present standard broadcast receiver that can play any part in the reception of FM programs is the audio amplifier stage and the loudspeaker.

They operate in the same manner as when a record player is plugged into the phono input jacks that are provided in most all high grade modern receivers for record players or television sound. A really good audio stage and loudspeaker are absolutely necessary to reproduce faithfully the high fidelity, noise-free FM signals that are tuned in with this, or any other, FM adapter or receiver.

FM broadcasts are confined to the 42 to 45 megacycle band, and the maximum range is from 25 to 50 miles depending upon the power of the station, the height of its antenna and the height and efficiency of the antenna used for receiving. The simplified adapter illustrated and described has been designed for easy assembly at the lowest possible cost consistent with high quality results. It em-

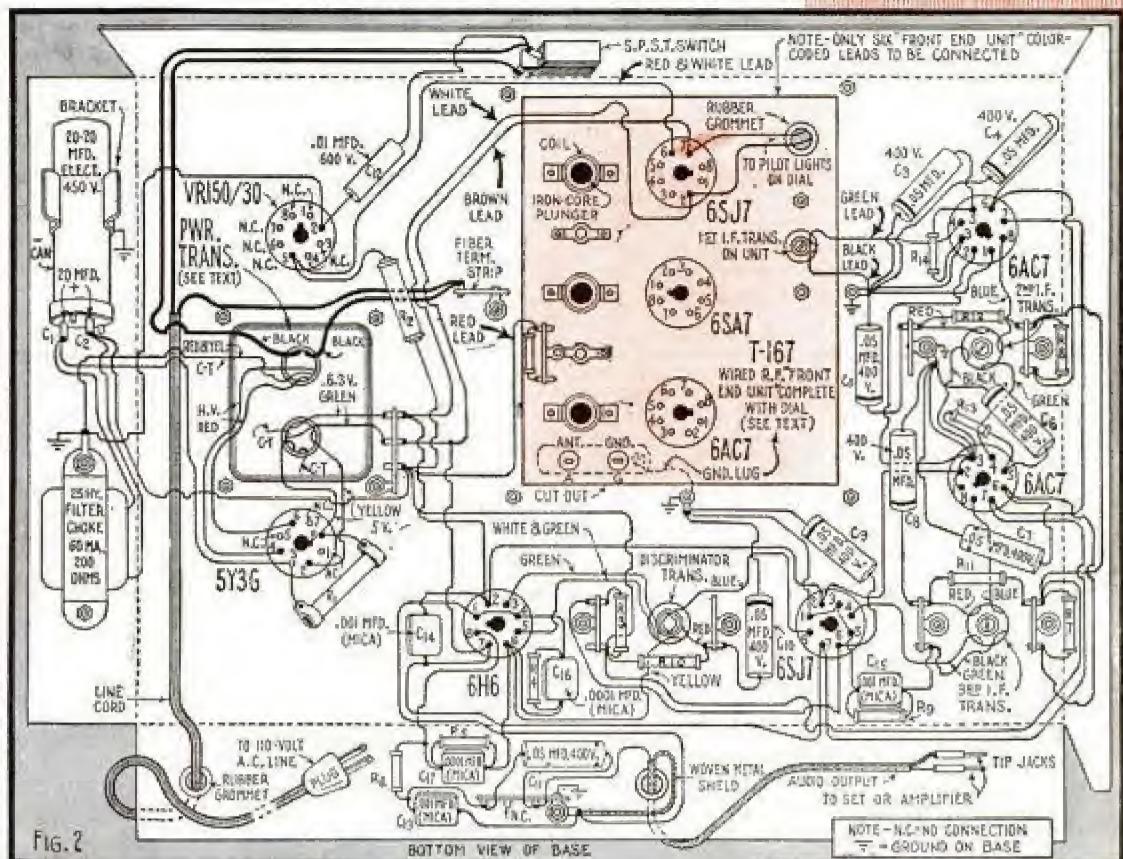
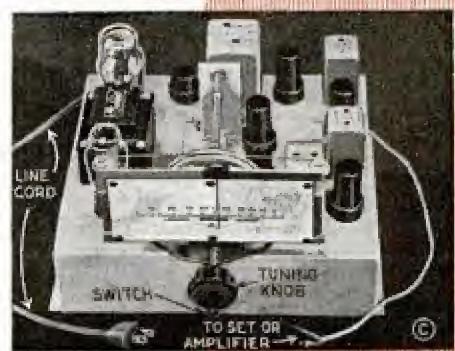


FOR YOUR RADIO

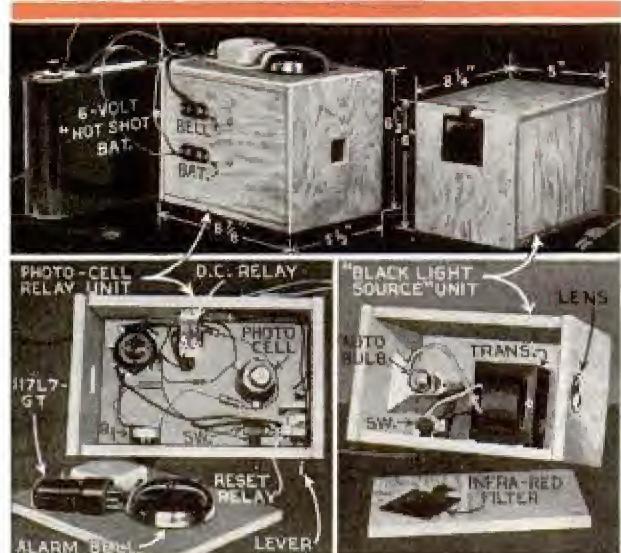
USES PERMEABILITY-TUNED
FM "FRONT END" R.F. UNIT

ploys a new and economical pre-wired and balanced r.f. "front end" unit, the coils of which are permeability tuned, thereby eliminating an expensive 3-gang variable condenser. Small plungers made of iron filings suspended in a bonding agent move in and out of the three coils simultaneously. This T-167 Carron r.f. unit includes the dial and may be purchased completely wired for about \$14, ready for mounting in the chassis base detailed in Fig. 1. There are only 6 color-coded leads to connect in the circuit which follows standard superheterodyne practice. These leads are clearly shown in the tinted section on the simplified wiring diagram Fig. 2, and all other radio parts are easily mounted and connected by the builder. The complete schematic circuit diagram and the FM antenna details appear in Fig. 3.

(Continued to page 178)



"Black Light" Magic Box Burglar Alarm System

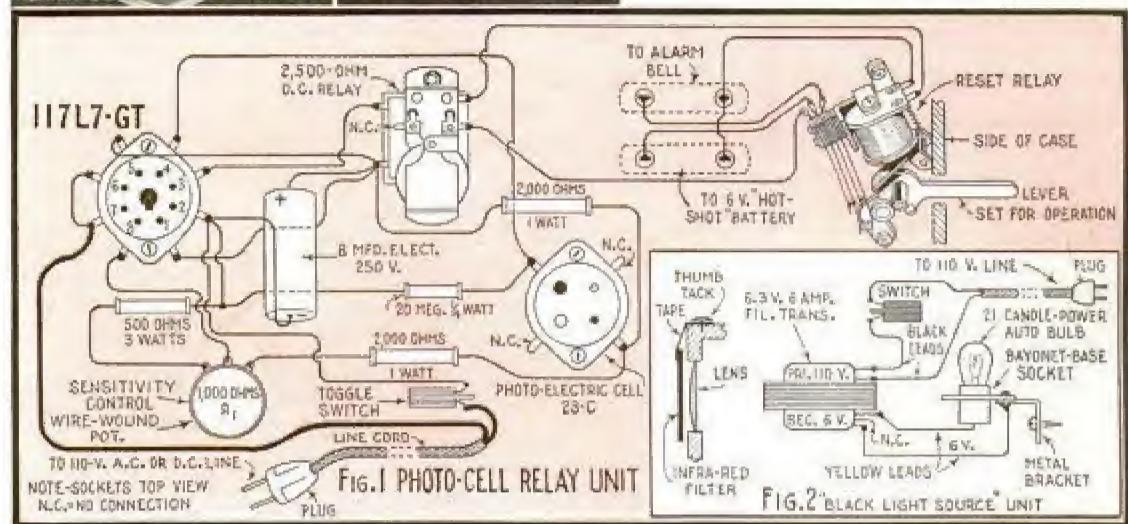


ONLY a few radio parts, a 68-cent infra-red filter, a 45-cent 6-in. focal length lens, etc., are required to build this electronic type burglar alarm system. Operating an alarm bell on an invisible "black light" beam at any distance up to 50 feet, this system is so designed that if an intruder interrupts the beam the alarm bell will ring continuously until the lever on the reset relay is manually reset even though the intruder steps out of the beam. Any interruption of the current in the house or plant building, such as cutting of wires, also will cause the alarm bell to ring as the bell is independently powered by a 6-volt battery.

The units are housed in simple homemade cases of $\frac{3}{8}$ -in. plywood, and must, of course, be light tight. All dimensions, parts and assembly details are clearly shown. The relay unit sensitivity control, line switch and reset relay are all mounted for control on one side. A 1-in.-square hole in the front end admits light to the "Cetron" 23C photo cell, the socket for which is set back about 6-in. from the hole so that extraneous light will not enter.

The light source case contains a 6.3 volt transformer, an automobile headlight bulb and its bayonet-type socket. A lens having a 6-in. focal length, and measuring $1\frac{1}{4}$ in. in di-

(Continued to page 180)

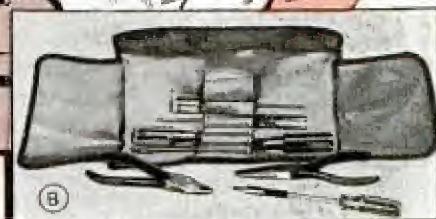
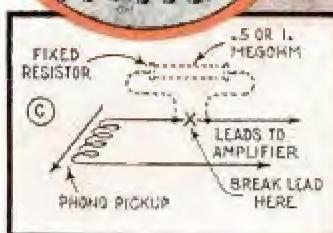
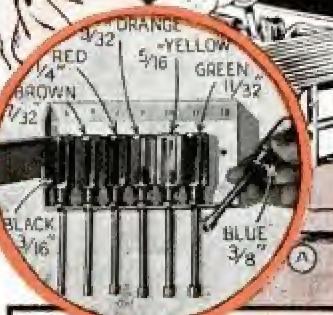


Practical RADIO HINTS

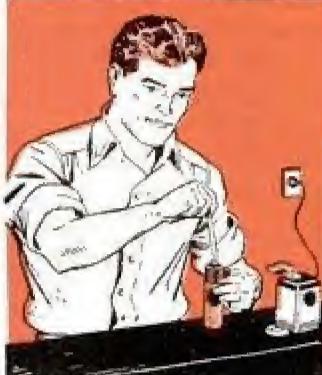
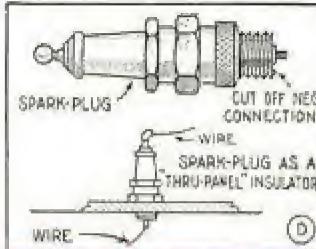
(A) Their colors save you time when selecting a nut driver of correct size. Made with "Xcelite" plastic handles in six different colors, you automatically think of size in terms of color and instantly pick out the one you want. A locking bar extends across the front of this kit rack



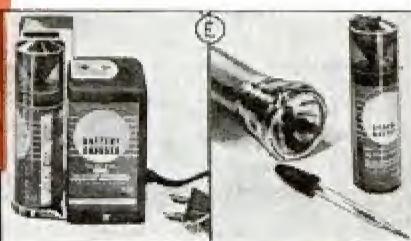
(B) Screwdriver kit and specially designed pliers for radio workers. Standard kits are made of fabricaid and come in two colors—green or red. (C) To increase bass response from crystal pickup, insert a $\frac{1}{4}$ -watt carbon resistor in series with one lead



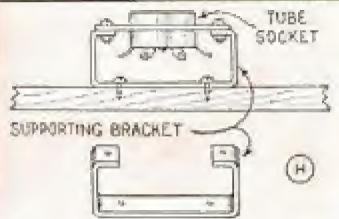
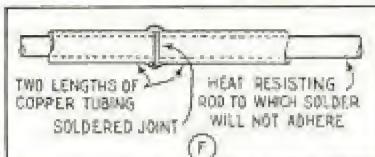
(D) Old spark plug makes good "thru-panel" insulator to pass antenna wire through a thin wall or panel. Take apart and clean; reassemble and cut off the point attached to shell



(E) Spillproof rechargeable battery replaces two No. 2 flashlight cells; charger operates from 110-volt a.c. line. When this 3-volt battery is used for small miniature-tube sets, connect a 20-ohm rheostat in series with one A-battery lead to reduce voltage for tubes. (F) To salvage short lengths of copper tubing, solder them together as shown. Grind down the ends to make a perfect butt joint. Supporting rod may be graphite or similar material



(G) No tools are required to connect this plug; merely insert wires and screw on cap which forces teeth through insulation to make contact. (H) Mounting for octal sockets on a breadboard



Seven-Tube Chairside Receiver Has Automatic Record Changer



Offering practically everything in luxurious listening comfort, this chairside radio-phonograph combination is an a.c. superheterodyne with phonograph-compensated circuit. Features include: six push buttons, tone control, drift corrected electric tuning, built-in antenna, standard and short-wave bands including band-spread tuning, amplifier for stronger short-wave signals, automatic record changer and record compartment. Dimensions are: 23 $\frac{1}{8}$ in. high, 16 $\frac{1}{2}$ in. wide, 25 $\frac{1}{8}$ in. deep.

One-Hundred Watt Amplifier

Designed for stadiums and large auditorium applications, this powerful amplifier has 4 microphone input channels, and employs an external speaker selector and



matching unit for 6 speakers. This provides for the use of a single 500-ohm line from the amplifier to the speaker selector. The unit can be placed several hundred feet away at the general speaker location.

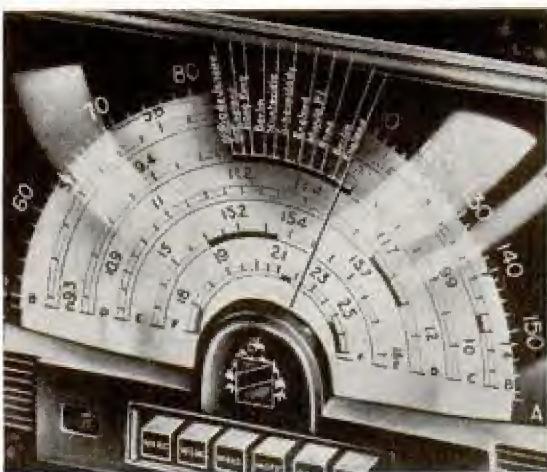
FM Speaker Has Tone Diffuser

Overcoming a tendency of FM high fidelity high notes and overtones to focus in a direct beam of sound, one manufacturer claims this built-in tone diffuser gives an even distribution throughout the room.



Super Band-Spread Dial

Twenty times more space is provided on the dial of this new receiver for important



foreign short-wave stations, by spreading out a narrow point on a wave band so that weak distant stations are easily separated.

Blueprints covering simplified radio construction articles in this and past issues are available for 25c each. Many popular tested circuits to choose from. Original detailed parts lists with names of supply sources, can be obtained from Popular Mechanics Radio Department upon receipt of postage.

NEXT MONTH—How to Build the Little Giant A.C.-D.C. Three-Band Super. This 1942 model of the popular low-cost receiver is a 4-tube super that covers the broadcast, intermediate and short-wave bands with plug-in coils. Easy to build; a fine DX performer. Also—**A Cigar-Box "Wireless" Record Player.**

WINTER SNAPS ARE SIMPLE...SURE

We're bagging beauties like this right through the winter—with our regular summer-time film—



KODAK VERICHROME



...and we're just as good indoors at night—thanks to super-fast

**KODAK
SUPER-XX**



OUTDOORS—Use Kodak Verichrome Film for your outdoor pictures this winter. It helps overcome small exposure errors, extends the "snapshot day," lets you get swell snapshots even when the weather isn't just right.

INDOORS AT NIGHT—Super-fast Kodak Super-XX Film gives outdoor excellence to indoor pictures. Use it with Photoflood bulbs and cardboard reflectors. BOOKLET FREE AT YOUR DEALER'S. Also covers flash pictures...Eastman Kodak Co., Rochester, N. Y.



OUTDOORS...INDOORS...you can always count on KODAK FILM

Human Ant Hill

(Continued from page 85)

Thousands of citizens buy fruits, vegetables, dairy products, fish and meat which have been held in cold storage plants and cooled by brine which flows underground from block to block in insulated pipes in the district in which many of the food warehouses are located.

Probably least known of the larger systems is the network of more than 70 miles of pipes through which steam rushes at a 200-mile-an-hour clip from the huge steam plants, maintained by one of Consolidated Edison's subsidiaries, the New York Steam Corporation, into office buildings, hotels, apartment houses, and other large buildings. Because of the value of subbasement space which would be used for heating plants and fuel storage on the crowded island and the cost of hauling coal and oil and removing ashes, these buildings find it more economical to purchase steam than to build their own steam plants. About 1,000 truckloads of coal and ashes which would otherwise add to the daily traffic jam are thus kept off the streets.

In these steam producing plants, powdered coal is used to generate temperatures of about 2,700 degrees Fahrenheit in gigantic furnaces. Annual consumption of steam piped through the streets is above the 11,000,000,000-pound mark per year. The steam pipes are serviced through 3,100 manholes. The steam is delivered at a pressure of 125 pounds per square inch.

Through 2,500 miles of mains, some of them six feet in diameter, the Consolidated Edison system also distributes more than 34,000,000,000 cubic feet of gas annually. To cover the widely scattered territory, the gas distribution service requires four large tunnels under the rivers, and at five other points, great mains are laid on the river beds. More than 38,000 manholes are necessary to service its electric light and power cables in four boroughs of the city.

Sheathing operations on this one company's electrical conductors require more than 135,000 tons of lead—enough to provide 55,000,000,000 packages of cigarettes with lead foil and have some left over. The total amount of lead buried under the surface of the city in utility service lines is above 230,000 tons. In spite of this and other insulation it is necessary to keep



2841
power lines away from communication lines because of interference. Ducts to carry power lines alone extend 17,500 miles in the twisting jungle of steel, iron, lead and copper below street level.

At peak operation on a dark day, users draw on the power lines of this company for around 25,000,000 kilowatt hours. The city uses almost twice as much electricity as Boulder Dam generates.

It is hard to visualize the subterranean operations of the New York Telephone Company. At one point or another four-fifths of the 9,400,000-mile wire network dips beneath the surface. There are 43,600 tons of copper alone in its underground cables.

Without this subterranean system, it would be impossible to handle the daily average of around 8,800,000 phone calls. Sixty years ago, lower Broadway and the financial district were literally festooned with wires; poles made a veritable forest of the city's streets. In the 1880's there were poles which carried as many as 150 wires on 15 cross-arms.

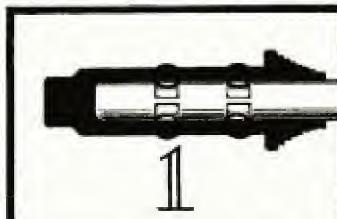
Thanks to the scientific research of the Bell System and other utility organizations, one of the modern 2,121-pair cables will do the same work which called for 70 rows of poles, each holding aloft 60 wires.

Telephone cables are run through permanent vitrified tile or iron conduits set in concrete. The largest conduit carries 216 ducts and is more than seven feet wide and eight feet high. When trouble is reported, instruments are used that measure the resistance encountered by an electrical current flowing from a maintenance point to the point of the break. From this measurement the location of the break can be computed. If the cable is accessible, the trouble-shooter can locate the break with an "exploring coil" or "fault finder." As he passes this instrument along the cable, he hears a constant buzzing signal until he comes to the spot where the wires are grounded or crossed. The buzzing noise then stops. Whereupon he starts his repair job.

Add up this amazing collection of subsurface wires and tubes, water mains to carry about a billion gallons of water a day and sewers to remove the waste, and it becomes apparent that New York City is in some respects as "colossal" beneath the sidewalks and streets as it is above.

Stanley Screw Driver

No. 25



1

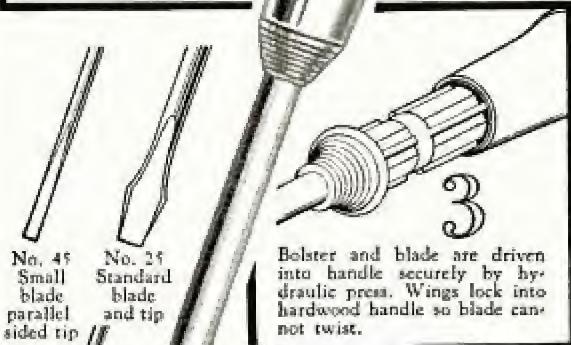
Blade tempered entire length. Recesses forged into butt end which is driven into steel bolster . . .



2

Bosses are swaged into blade recesses. Four sharp wings are swaged on outside of bolster. Blade is now locked into bolster . . .

STANLEY
Trade Mark



3

No. 45
Small
blade
parallel
sided tip

No. 25
Standard
blade
and tip

No. 55
Small
blade
bladed
tip

Bolster and blade are driven into handle securely by hydraulic press. Wings lock into hardwood handle so blade cannot twist.

This patented construction makes it possible to temper the blade its entire length, providing greater strength. Stronger, better insulated, and with accurately machine cross-ground tips, the Stanley No. 25 Screw Driver is made in 8 lengths, 2½" to 12".

See them at your hardware store, or write for Catalog 35, which describes all Stanley Tools.

STANLEY TOOLS

Division of The Stanley Works, 105 Elm St., New Britain, Conn.

THE TOOL BOX OF THE WORLD

The Ship That Never Sails

(Continued from page 69)

means spotless when it refers to the condition of eating quarters.

The third week usually begins to show whether there is hope of making a sailor out of him. Cooped up with his fellow men for long periods, the seaman cannot be too morose, quarrelsome or of downright bad character. During this week he begins to find out how difficult it is to get into a swaying lifeboat, how quick he must move to his station when the emergency call sounds and he is taught how to raise and lower the boats from their davits.

By this time he is talking the language of the sea and has picked up the spirit of the thing if he is ever going to. He learns



Novices have boat drill on land before dipping oars

to snap into it when a fire alarm is sounded, rush to his post and handle a fire hose, or a carbon dioxide extinguisher. He is introduced to oxygen and gas masks. He hears lectures on disasters at sea such as the Morro Castle and the Halifax blast during the last war and his instructor points out the human errors which were fatal in each case. He is taught to follow routine in case of a fire at sea, or in the tense moments when a great vessel is sinking, but he is also encouraged to use his wits, for no disaster at sea is exactly like another. Motion pictures and lectures acquaint him with the methods of ship propulsion, whether by gas engine, Diesel or steam. He learns to tie knots and grasp the principles of rigging, gets used to climbing ladders of rope and wood.

By the end of the first month, his training is amplified in each of these latter branches with special emphasis on boat drills.

The next two weeks introduce him to the use of weapons, which range from anti-aircraft machine guns to four-inch broad-

side guns which are commonly placed aboard merchant craft in time of conflict. He learns to load and gets the necessary muscle, by toiling hour after hour with the 50-pound dummy projectiles which he must carry to the big guns, thrust in, and catch on the rebound when they are "fired." There are modern range finders and classrooms where gunnery problems are worked out on regular blackboards. He is taught not only to fire weapons, but to take them apart, clean them, and even to make repairs if necessary.

Soon, according to his aptitudes and desires, he begins to be a specialist, whether it be a fireman or an oiler below deck, or a seaman on deck. If he likes the cooking and waiting tables, he slants into a steward's course.

If he becomes a deck seaman, for instance, he is placed on a crew which handles the exact duplicate of a hatch aboard an ocean-going ship. Of steel construction with regulation heavy wooden hatch covers, winches and booms, the dummy hatch receives dummy cargoes hour after hour as the apprentices learn to hoist the great covers, load heavy metal objects in cargo nets, steady them while they are lifted and lowered, and run the steam winches. The hatch is only about four feet deep instead of the 25 or 30 which would ordinarily lead to the hold of a big ship. This saves many an apprentice a tumble below. By the time they have learned to operate the hatch and its engines, they have also learned how to be careful.

Three months aboard Hoffman Island and they are ready to be placed on one of the training ships which the United States Maritime Commission has placed at their disposal. Among these are the American Sailor, the American Seaman, and the Empire State, ships of the 5,000-ton class. Voyages to ports as far away as the Caribbean and tropics put the final polish on their education.

Thus the ship that never sails has saved them nearly two and one-half years in training for a seafaring career.

Write to the firms listed in the Where-to-Buy-It index, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

How "Quality" is Built into DELTA 6" JOINTERS

Here's the story of the unseen "hidden" quality that is built into one Delta machine — a story typical of the entire line of Delta machines.



EXTRME accuracy is a vital necessity in building satisfactory jointers. If the tables of a jointer are out of alignment by as little as *five thousandths* of an inch—this can make a piece of work only 3 feet long a full $\frac{1}{8}$ " narrower at one end than at the other! This is impossible with Delta Jointers because of the special precision grinding of the tables. The tables of the jointers are first rough machined singly. The entire jointer is then carefully assembled with the tables mounted on the base—and both tables are then accurately ground at the same time on huge, expensive surface grinders (illustrated above) within extremely close limits. The tables are then carefully inspected with special gauges (as shown in photo) to insure their being in alignment and absolutely parallel. This is but one



of many processes used in building Delta Jointers to assure you of the dependable accuracy that has become synonymous with the Delta name.

MANY OUTSTANDING FEATURES

make this the finest 6" Jointer available. These include: Heavy Cast Base and Tables; Tables carried on Gibbed Dovetail Ways; Patented Tilting Fence; Patented Automatic Stops; Free-Swing Dual Control; Depth of Cut and Tilt Scales; Double-Seal Ball Bearings, Lubricated for Life; Front Safety Knife Guard; Safety Type Head with 3 High-Speed Steel Knives.

Send for Delta Catalog

Write for the new Delta catalog which is a complete guide book to power tools. It not only lists the entire line of Delta "Quality" wood and metal working tools—but shows you the important points to look for in all power tools. It illustrates and explains the advantages of the many hidden features of design and construction that make for long, better service in power tools. (Also send for Project Book No. 8 crowded with new projects, including working drawings, photographs and full instructions.)

The Delta Manufacturing Co., (Dept. 681-B)
600-634 E. Vienna Ave., Milwaukee, Wis.

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City _____ State _____

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4 HANDY SIZES
10¢ 25¢ 50¢ 85¢



Hitch-Hiking on the Big Waves

(Continued from page 75)

ing under the wave and letting it clean him up. But that is against the code when the surf is crowded with riders. It means a loose, thrashing board which is liable to ram somebody, whereas his presence on the board will both weight and guide it.

There is no alternative. He paddles furiously to get his start, then scrambles to his feet, well back on the board to prevent nosing over into a "pearl dive." The upward draft of air sucked by that thundering juggernaut almost takes him off his feet. Behind he sees that the water is "feathering"—that is, it is developing a white cap, which, if it breaks over, will mow him down, give him the works, and hurl him on the beach like a drowned cat. He slides his board down the wave at an angle, and evades the mow down by inches. And suddenly he finds himself riding in triumph with the war-whooping veterans, streaking toward shore, half a mile away.

Magnesium-Thermit Fire Bomb Creates Intense Heat

One of the most destructive bombs, for its size at least, is the "electron bomb" developed by the Germans. It is said to weigh two and two-tenths pounds, making it possible for an airplane to carry 2,000 of them, whereas the limit for high explosive bombs is 50. Its shell, about nine inches long, is 80 percent magnesium, and contains several ounces of thermit. Instead of serving as the incendiary material, the thermit merely ignites the magnesium shell, the latter burning for 10 or 15 minutes at approximately 2,372 degrees Fahrenheit. Jets of flame spurt from vent holes in the shell and bits of molten magnesium scatter in all directions for a distance of about fifty feet to ignite any combustible objects within range. Because of their lightness it is impossible to drop them with any degree of accuracy. Twenty bombs released together from 5,000 feet might strike anywhere within an area of 10,000 square yards. Therefore they are suitable only for indiscriminate bombing.

Look in the index to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.

28 / 2

Battling War's Fire Bugs

(Continued from page 43)

similar substance—and providing proper fire extinguishers, as described below.

Water and other common agents—foam, carbon dioxide, carbon tetrachloride, sodium bicarbonate—are worse than useless against burning magnesium. They intensify the flame. Water reacts with magnesium to produce hydrogen—itself a flammable gas—and magnesium hydroxide. Water feeds oxygen to the flames more rapidly than does air.

British fire fighters use snuffers—inverted bowls of wire mesh sprayed with asbestos—to prevent spread of the fire. They also use long-handled claws to grip the bomb and remove it. Powdered graphite, talc or similar substance inert to magnesium will help localize the flames by smothering. Properly used, water will hasten the burning of the bomb itself and prevent spread of the fire to surrounding combustibles. Automatic sprinklers are useful for wetting down the surroundings, especially if the fire is small, as around magnesium machining operations where chips may ignite. The latest and perhaps most effective material for fighting magnesium flames is a dry powder developed by Dow Chemical company, a leading manufacturer of magnesium alloys, and Pyrene Manufacturing company. It is a noninflammable powder inert to magnesium containing a small amount of material which forms a heavy vapor when heated and shuts out air.

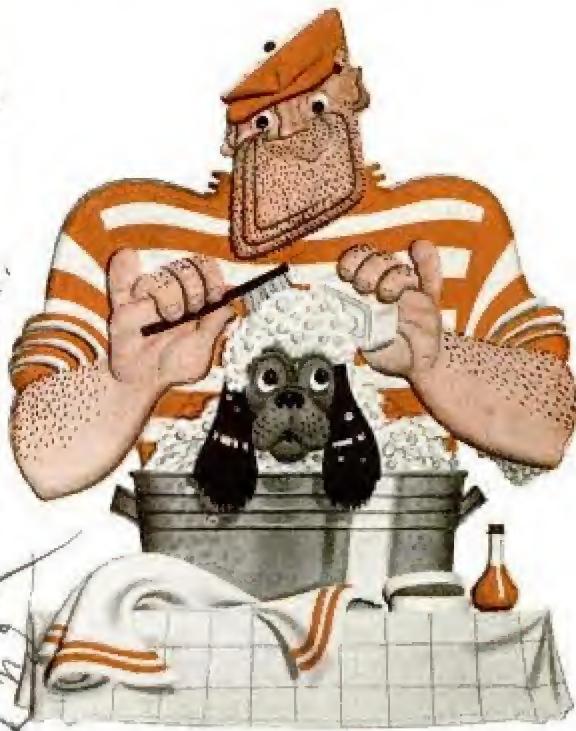
The National Fire Protection Association is leading a preparedness campaign against fire and sabotage. In a handbook, "Fire Defense," it has compiled information on the organization of fire wardens, how to fight various types of fires, the handling of bombs, maintenance of water supply and communications in emergency.

Breakdowns of water lines and communication systems are hazards that must be anticipated. Automatic sprinkler systems are essential, yet they can be nullified by failure of the water supply. A plywood plant in Washington was destroyed with a \$525,000 loss and two employees were burned to death. Afterward the sprinkler system valve was found almost closed. Similarly, a Massachusetts mill was wiped out by fire while its sprinklers were dis-

(Continued to page 168)

TOUGH

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FOREDOM ELECTRIC COMPANY
Dept. 305, 27 Park Place, New York

connected. Fire brigades in factories must know where the valves are located and how to get water if the usual supply fails. In an air raid, when mains are broken, firemen must cut off the waste by closing valves, then pump from the nearest stream or pond.

Authorities state that practically no city in the United States has enough fire alarm boxes. Signaling and communication systems must be made proof against interruption by any cause, even the seemingly impossible air raid. Police and fire departments are rapidly being equipped with radio, and in this way are well prepared.

America, we hope, will escape aerial bombing. One high explosive 2,200-pound bomb demolished four English houses, seriously damaged 20 more within 200 feet and partly wrecked 119 others. The explosives America is alert for are the infernal machines of the saboteur.

There is no absolutely safe way even for an expert to handle an unexploded bomb. It is a popular and dangerous notion that a bomb can be rendered harmless by "dunking" it in water. Actually, water may detonate the bomb. Water may short-circuit its electric mechanism. The bomb may be made of a metal that bursts afame when water touches it. The fuse of a dynamite bomb may be waterproof. If a quenching agent is essential, light lubricating oil or kerosene would probably stop any clock-work mechanism. But nothing is quite safe. A bomb expert was called to a post office to investigate a suspicious package. He took every precaution: working with special manipulators from behind an armored steel shield, he watched through a periscope as he endeavored to render the bomb harmless. But it exploded, drove the shield against the wall and crushed him.

When a bomb is discovered, get an expert. Open all windows and doors to let the blast escape. Use sandbags or mattresses to stop flying fragments. Remove flammable materials, shut off gas and other utility lines. If it is possible to move the bomb out of a building, drag it on a rope at least 50 feet long, but avoid any jar.

Sabotage is less likely to occur if we are alert to prevent it and ready to combat fire and explosions effectively where they do break out. And the nation that is ready to fight the incendiary will be better prepared in peace to fight the annual toll of \$300,000,000 in fire losses.

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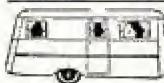
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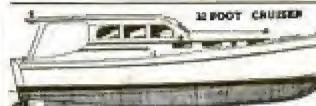
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21/68

Smokeless Town

(Continued from page 79)

something entirely new in construction—an entire community with every home electrically heated. In his new Meadow Hills, which will have more than 100 homes, the electrically heated homes cost from \$3,100 up.

Meadow Hills homes are built especially for electric heat. "A low-cost home without electric heat is out of date before it is built," Fonde declares. "If properly applied, electrical heat, in my opinion, is cheaper and more desirable than any other automatic heat now in general use."

"The proper construction and insulation of the home is just as important as the use of a good heating unit. Builders should give more attention to sturdy construction, with special attention to the small leaks about the house."

"Weatherstripping of doors and windows is likewise necessary and should be well done. A complete weatherstripping and insulation job will cost only about 4 percent of the cost of the small home and will amortize itself in about 10 years in fuel costs and give added comfort."

Forest Court was used as a proving ground for Fonde's theory that low-cost homes with quality and beauty, using nationally advertised products, could be built.

The system used helped. An order was given in one block to Fonde's affiliated supply company. The supply company detailed all millwork through its shop as one order. Everything possible was done in the shop instead of on the job. Sash and screens were fitted in weatherstripped window frames and painted before being taken to the job. All casings were hand-cleaned, mitered, splined and glued at the shop.

"On the job itself we studied every means to cut corners," said Mr. Fonde. "Electrical equipment was used, templets were made for cutting studs and crews were worked in groups. Certain men were put on joist, others subfloor, others studing and so on. We used the taped joint gypsum wallboard, which permitted the job to go through without the usual delay caused by plastering."

Power tools were found to be a help in keeping down costs of construction. Fonde estimates that a power handsaw will pay for itself on one \$16,000 residential job.

MONEY MAKING OPPORTUNITIES

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HOW WONDERFUL it is when we can turn our interesting hobbies into cash. And it is possible! Brush electroplating offers the opportunity. Right at home some make a good living —as much as \$30 or \$40 a week. Here's what one

home electroplater of Chicago says: "I bought my electroplater to experiment with during my spare time. In a few evenings I earned the cost of the machine by plating jewelry, silverware, headlight reflectors, etc., for friends and neighbors. Now I have all I can do. I recommend this machine to all who want a profitable business."

This man apparently finds business easily. So can you. Besides the articles he lists there are electrical appliances, surgical and dental instruments, restaurant silverware, boat hardware, musical instruments and many automotive parts.

J. J. Wilson, Slidell, La., writes: "After I received my electroplater I practiced for about an hour. I made up four samples and went out after business. One of the large chain restaurants now has me do all their silverware."

Max Hemmert, Idaho Falls, Idaho, states: "I am now spending all my time in plating work. I purchased a brush plater last summer and have worked up a very promising business."

Frank Welde, Philadelphia, goes after garage business. He writes: "I electroplated a few brass strips for samples. I then showed these strips to different people and that's how I got plenty of jobs. I have all the work from a big garage. The owner gets 10% of what is charged his customers, and the rest goes to me for my work."

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Electroplates by Brush



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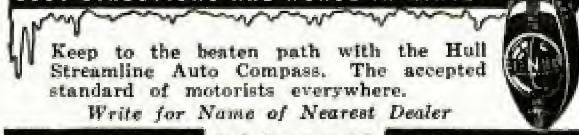


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This Modern Age of Mud

(Continued from page 53)

themselves and are producing pieces that appeal in simplicity, color, and humor. The heaviness and florid ornamentation of European art has been dropped. Much of the best of current artware, it is anticipated, will be future collectors' items just as the work of earlier potters is collected now.

The potters' craft has always kept most of its formulas and methods secret and performed most of its operations by hand. Now, however, mechanical improvements are being made and in some potteries the clay is hardly touched by hand. The traditional beehive kilns have been improved by downdraft firing arrangements. In many branches of the industry the beehives are being replaced by long tunnel kilns in which the ware, stacked on iron carts, is slowly moved through the fire zone in the middle of the kiln.

Potters can't always duplicate the colors of some old pieces, including Egyptian turquoise and Chinese copper red, although the difficulty is not lack of ability but lack of the same raw materials. After fussing for years trying to duplicate the turquoise of a 3,000-year old Egyptian vase, one potter wrote to Egypt for some samples of Nile clay, and achieved the duplication.

By experimenting, potters have achieved a number of curious effects. Titanium oxide when used as a glaze has the curious property of turning lighter when an object rests on its surface for a short time, gradually darkening to its original shade after the object is removed. Glazes that resemble metal are often applied to art objects and by means of one special treatment an actual metallic surface is sometimes used to coat a vase or figurine. Some experimenters have reproduced photographs under a transparent glazed surface, and others have made high-fired ceramic ware as durable as metal pots for stove cooking.

Porcelain enamel, the glasslike and enduring surface that is fired onto metal objects, has found a place in the construction field and is used for decorative store fronts, for permanent roofing, and for roof vents and chimneys. It may become important in shipbuilding, where porcelain enameled handrails and other fixtures can take the place of brass and copper needed for other defense work.

Speed Demons of the Air Forces

(Continued from page 59)

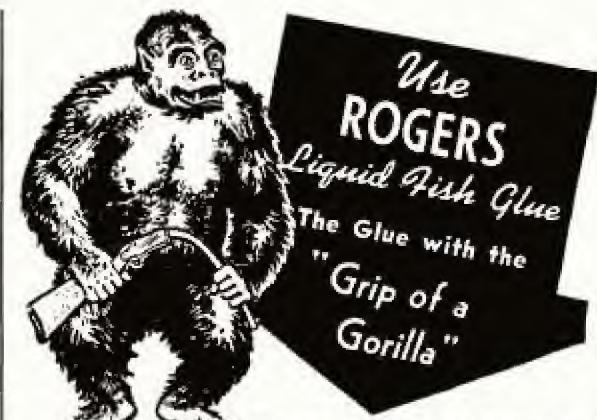
firing far enough in front of the moving target to give his bullets a chance to arrive at a certain spot simultaneously with the target. There are no mechanical adjustments that can be made to the gunsight; marksmanship depends on the pilot's skill alone. That's the reason every pursuit plane base is equipped with its own skeet field. At least once a week the pilots spend an afternoon at skeet shooting. This gives them excellent experience in shooting at flying targets.

Flying at his target, the pilot is taught to get in as close as he dares before firing. Fire from 100 yards is far more effective than from three or four hundred yards away. He has to follow through while firing so that his bullets will continue to pound the target, just as he has to follow through while firing at a clay pigeon on the skeet range. By now he has to be on his toes to avoid a collision, yet he dare not pull out in any direction he pleases. To do so might expose himself to return fire, so he has to turn toward the target's blind spot to avoid being shot down while he is escaping.

The battle for air supremacy is a seesaw. For a while the pursuit planes had an edge over the relatively unprotected bombers, then the bombers added heavier defensive guns and ganged up to keep the pursuits away. The answer to that was to increase the fire power of the pursuits to allow the fighter pilots to get in killing blows before the bombers could blast them out of the sky.

A pursuit plane used to be armed with a couple of .30-caliber machine guns. Now a pursuit plane is apt to have eight or ten guns mounted in its fuselage and wings, including 20 and 37 mm. cannon as well as .30 and .50-caliber machine guns. The result is that when the pilot presses the master firing trigger under his thumb an actual hail of bullets pours out in front of him. Each fifth bullet is a tracer.

Fully loaded, his plane holds several thousand rounds of belt- and clip-fed ammunition. This is enough for only a few seconds of firing, but since the pilot is on his target for only split seconds at a time, the ammunition that he carries is enough for a long battle.



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(Continued from page 95)

and chisel, knocking off an eighth-inch covering of barnacles and rust from the bottom of a City of New York garbage scow, a tedious job which must be done carefully. As he progresses, he may find himself using a pneumatic hammer and chisel on a steel deck. Here he must be even more careful, or his instrument will knock a hole in the deck. He'll learn to clean the deck or hull with a wire brush.

If he is a painter, he will follow a chipper over a cleaned area of steel hull and coat the exposed metal with red lead, anticorrosion paint and finally an antifouling mixture which discourages barnacles and other underwater growths.

Perhaps the newcomer will get a chance to learn drydock operation. The intricate valves which flood huge tanks with water to lower a drydock, and the valves which pump air into the tanks to raise a vessel will have to be measured and he will learn how to set the drydock blocks which will support the craft without damaging its hull after it has been raised from the water. He will also find out how to rig the ropes to hold a boat where the blocks will catch the hull as the drydock rises.

If he gets a chance to become a shipwright, he may find himself tapping the hull of a wooden coast-guard patrol boat with a hammer until a dull thud instead of a hard ringing sound tells him he has found a weak section. If his foreman verifies his find, he and his crew will chisel away the damaged plank about four feet on both sides of the weak spot and then prepare a fresh plank in the precise dimensions necessary. He will fasten the new plank in place with screws and caulk the seams so the patched area will be as sound as the rest of the hull.

In the blacksmith shop he might learn to forge nuts and bolts of special sizes and dimensions; in the carpenter shops he might do many of the hundreds of carpentry jobs that turn up on a vessel which battles the seas. In the machine shops he might be taught not only to use tools, but to repair them.

While the Staten Island shipyard, at which the training program was launched on an experimental basis, is being closed, work is being continued at other yards.

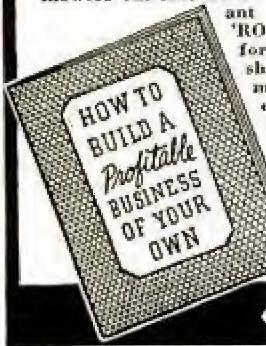
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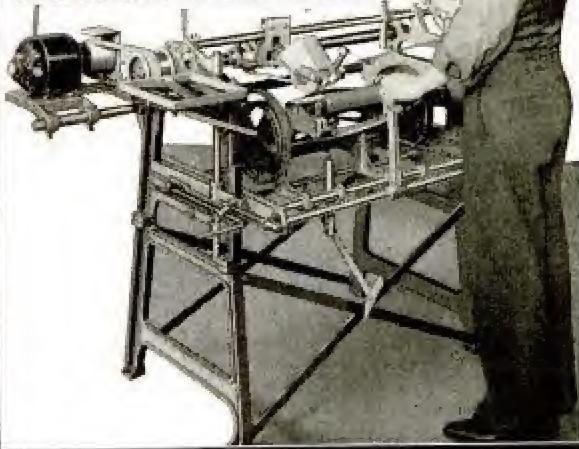
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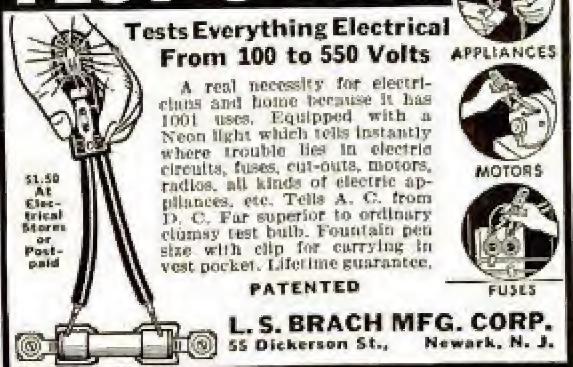
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29-19

Solving Mysteries of the Deep

(Continued from Colorado Section)

of his rod into the socket, and waited for this giant to strike as the boat tempted the fish with bait trailing about 75 feet off the stern. The swordfish struck the bait, and, to everyone's joy, returned to take it.

For two hours the fight continued between Michael Lerner and the fish, which outweighed him several times. Repeatedly it was brought to the boat, but even after 80 minutes of conflict, it was able to sound again more than a quarter of a mile into the ocean's depths. It began to look as if the 30-foot wire leader had wrapped around the fish.

In another ten minutes this fear proved well grounded, and the big one snapped the snarled leader—and got away.

Then one day on the squid grounds, Michael Lerner finally got his broadbill. It came to feed on the slimy "nightmare of the sea." Its capture took him about an hour of toil and was the first swordfish ever taken on rod and line in Peruvian waters!

Patient fishing eventually brought another to boat. The specimens were hurried ashore, and on the beach members of the party immediately made plaster molds. Next, the fish were skinned and the skin preserved so that it could be stretched on casts made from the molds. Internal organs were extracted, and placed in milk cans, immersed in a formalin solution.

The search for giant swordfish, had, of course, enabled the party to land many other game fishes and these were likewise preserved for shipment to New York. Then the expedition moved on to Chile where its success was even greater.

From his experience, extending half way around the world, Michael Lerner has discovered that there is no way of judging how long it will take to land a big fish like a swordfish. One, taken off Chile, weighing 668 pounds was landed in 39 minutes. Another 601-pounder, off Cape Breton, Nova Scotia, fought more than four hours. Mrs. Lerner battled one seven hours, only to lose it right at the boat; and then landed one weighing 570 pounds, off Chile, in 50 minutes. Some put up their battle near the surface, others sound so deeply that 1,500 feet of line go down after them. Marlin are more active battlers, leaping out of the water often 50 times when hooked, and "greyhounding" and "tail-walking" across

the surface. Caught in the corner of the mouth, game fishes, apparently regarding the hook as another and particularly disagreeable parasite, go through remarkable gyrations for long periods of time. If they swallow the bait, however, loss of blood hastens the end of the struggle. If a fish is hooked in the eye or where some vital nerve becomes paralyzed, it can be reeled in with very little effort in a few minutes.

When the expedition's catches have been received at the American Museum of Natural History, in New York, the Museum's scientific detectives begin minute examination of the specimens and plotting maps of the catch. If they can establish that great numbers of very young fish are found in certain localities, their quest for the feeding grounds will be getting warm. If they can find females nearly ready to spawn their 15 to 20 million eggs each, they will presume they are near the breeding places. If males are with the females, another clue would be added. Off Cape Breton, Nova Scotia, where swordfishing is a major industry, scores of female fish were found, but not a single male.

How and where do these most mysterious of game fish meet in the wide expanses of the sea? What draws them together at a certain point and time? Where do the young hide from their predatory fellow inhabitants of the deep? Why do great schools appear at one spot one year and change their wandering path the next? The answers to these questions will fill a blank in science and be of great value to commercial and sports fishermen.

29-1209

Eyes Get Credit for Equilibrium Once Given to Ears

The controlling factor of a flyer's sense of balance, formerly believed to be in the ears, is now accepted as being in the eyes, according to Col. Louis H. Bauer, consultant in aviation medicine to the Civil Aeronautics Authority. Recent studies indicated that no matter how perfect the mechanism of a flyer's inner ear may be, he is unable to keep his plane on even keel unless he can see the horizon, or has learned to fly blind, or he disregards the sensations resulting from stimulation of his internal ear.

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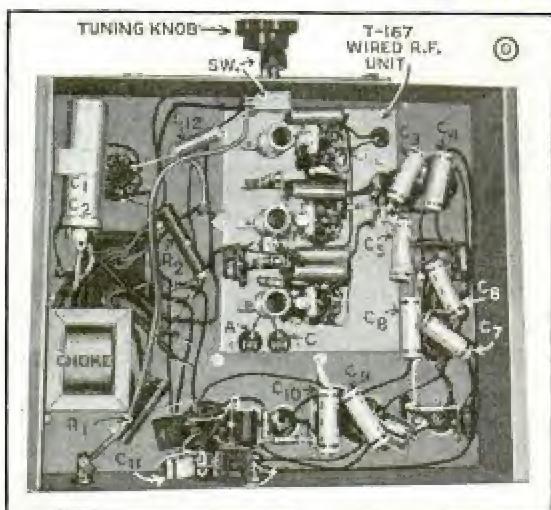
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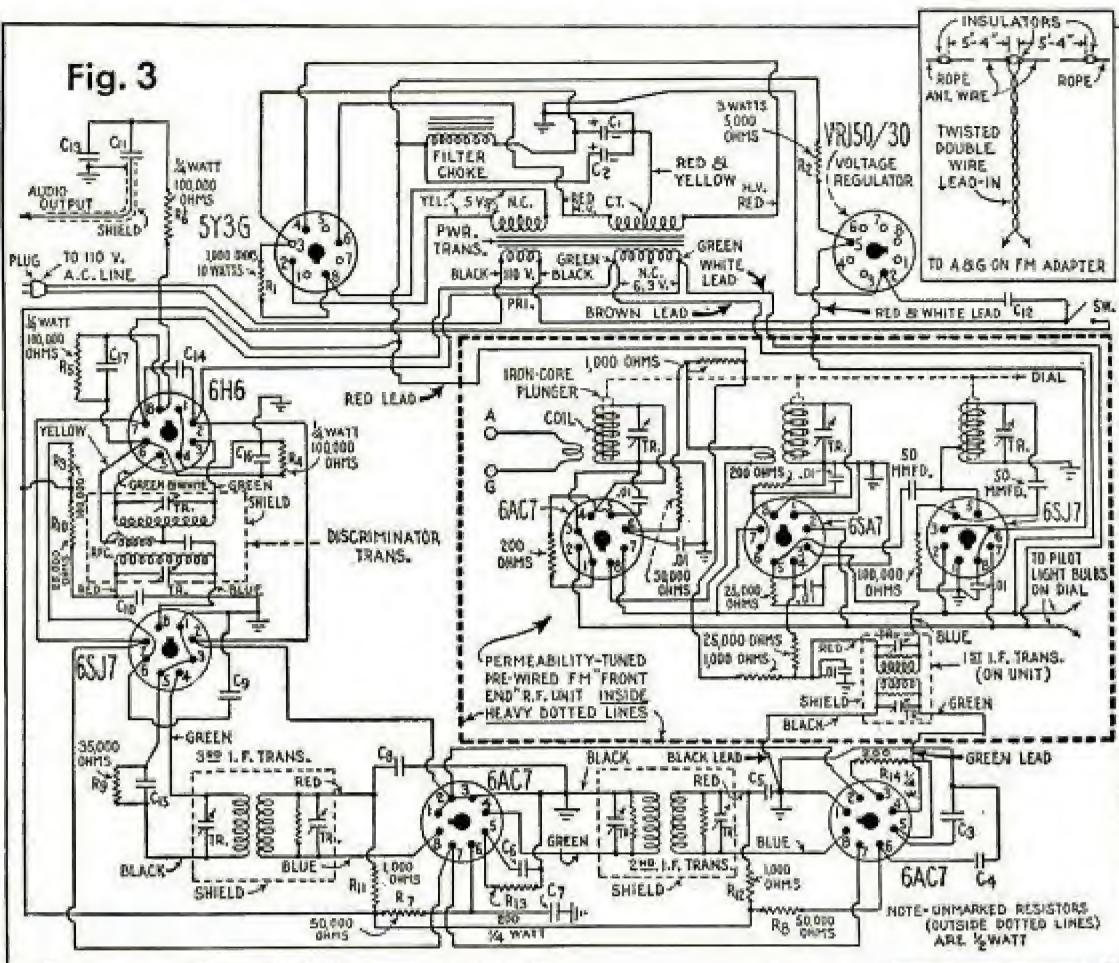
(Continued from page 157)



Mount the r.f. tuning unit on the chassis last in order to prevent damage during assembly and wiring. Wire carefully; make all leads from condensers and resistors as short as possible, and locate all of the tube

sockets and tubular by-pass condensers exactly as shown. The I.F. transformers are supplied pre-aligned but some "touching up" may be necessary. Frequency modulated transmitters and receivers reproduce the full musical range up to 15,000 cycles as compared with the 5,000-cycle standard (AM) broadcast stations. This means that musical overtones, sound effects such as sawing wood, washing dishes, dropping coins, bells, etc., are reproduced with lifelike naturalness. All this without the usual background noise of atmospheric or man-made static. Owing to lack of space, further FM circuit comment and additional aligning data are given in the detailed list of original parts which is available from Popular Mechanics radio department without charge, if desired. Photos A, B, C and D clearly show the arrangement of all parts above and below the chassis. The blueprint number of this article is R-299.

Fig. 3



How *Atlas* SERVES THE NATION

One in a series of messages showing how
Atlas helps in the armament program.

BAUSCH & LOMB
PRECISION
SHARPENS THE
"EYES FOR DEFENSE"



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The photographs below show some of the Atlas No. 73 Drill Presses on defense production in the Bausch & Lomb plant. The operators are typical of those who since 1853 have carried on the tradition of Bausch & Lomb precision machining. Atlas is glad to serve the nation through them in this critical year.

Photo by U. S.
Army Sig. Corp



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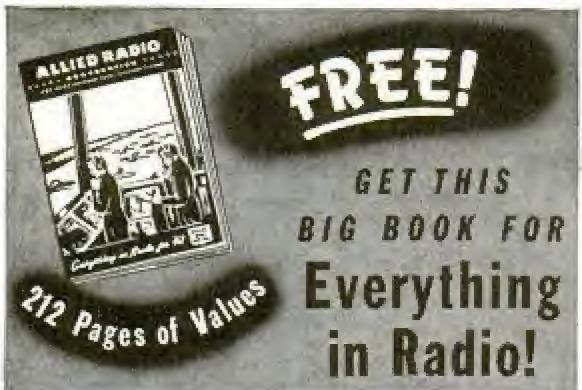
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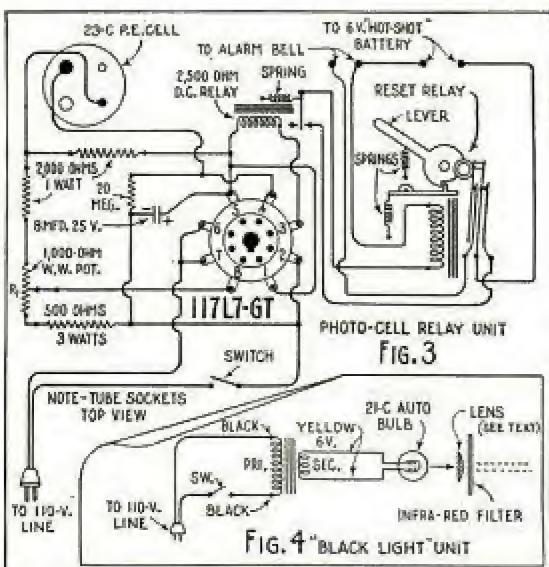
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"Black Light" Burglar Alarm

(Continued from page 158)

meter, is cemented in a slightly beveled hole in the front end of the case.

A metal bracket supports the bayonet-type socket, and completes the lamp filament circuit, bringing the bulb filament exactly 6 in. from the lens, and in a direct line with it. Figs. 1 and 2 show simplified wiring diagrams of both units; corresponding schematic circuit diagrams appear in Figs. 3 and 4. The "Guardian" T-11-3.5-C1



reset relay is mounted so that its lever extends through the case and works freely.

Mount the units at the same level, and, with the infra-red filter temporarily removed, adjust the light beam so that it crosses the doors and windows that are to be protected and reaches the photo electric cell in the relay unit. Mirrors may be used to reflect the light beam around corners. The cases are then permanently bolted in position and the infra-red filter fastened down over the lens. No white light should show from the case. Now before connecting the 6-volt battery, plug in both units and pass your hand back and forth across the opening in the photo-cell case and adjust the sensitivity control (R_1) until the relay can be heard to click up and down. Then pull the reset relay lever down until it catches, and connect the battery and the bell. The bell may be located inside or outside the building at any convenient point. The blueprint number for this article is R-300.

L1338 20 N Wacker Dr.
St Louis Mo.

You Can't Be Too Careful, Odd Accidents Prove

Accidents will happen, but most of them can be prevented by a little foresight. It may be your turn in 1942. Just as a warning that you can't be too careful, look at some of the strange mishaps reported to the National Safety Council in 1941. A student pilot was bounced out of his plane when it hit a down draft over East St. Louis, but he was amazed and pleased to land on the fuselage near the tail. He hung on like a scared jockey, riding backward, while the instructor did an expert job of landing gently. Another flier, less lucky, went into a tailspin at 3,000 feet and crashed. He crawled from the wreckage unhurt, but on his way to the highway he fell and cut two fingers to the bone. You can eliminate most fire hazards, but not the mysterious kind that afflicted an Indiana farm house. In one day it caught fire 28 times. First an upstairs windowsill caught fire, then a downstairs window, then a calendar on the wall, a bed spread, a pair of overalls hanging on a door, a book in a drawer, a layer of paper under a mattress. Finally the farmer tore down the house. No one knows what caused the repeated blazes; one theory was that the house was in a strong magnetic center where static electricity prevailed. A more obliging blaze in Athens, Ga., turned in its own alarm; the telephone fell from the burning wall and the operator, plugging in, heard the crackle of flames and called the fire department. Too often you read of hunters accidentally shot. It was different in the case of a California hunter who was knocked unconscious when the goose he had shot fell on his head. A New York motorist was hit simultaneously on opposite sides by two cars driven by brothers, and a caboose in Minnesota similarly was struck from both sides at a road crossing. A Texas woman sat in her car while it was being greased, forgot she was up on a hydraulic hoist, stepped out and fell to the floor. In one morning a Florida postman was bitten by a dog, stung by a scorpion in a mail box, ran a nail in his foot when porch steps collapsed, and trod on a rattlesnake. And the National Safety Council executive who collected these facts knocked himself out with a blow on the chin when the paint-stuck window he was trying to open gave way suddenly.

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81192 Cave Men Up-to-Date

(Continued from page 47)

rocks. Best garb for underground travel is a one-piece coverall; leather jackets are dangerous, as they're likely to roll up over your shoulders and pin you fast when backing out of a tight hole. More than one lighting system is essential: a pocket full of candles and matches, flashlights, and carbide lamps. The caver's knapsack, which can be shifted from chest to back, has nine or ten zipper pockets for map and data equipment, paper, pencils, compasses, measuring tape, chalk for marking stations mapped, a hand level to figure the drop from one point to another, extra flashlight batteries and thermometers.

In addition, cave explorers carry ropes and rope ladders, two quarter-mile spools of lightly insulated telephone wire and equipment for talking with others at the surface, and a special "ceiling indicator" for measuring ceiling heights.

"Following an experience in one cave," says Stephenson, "where one of our party coming to a pool of water and a rock barrier had to strip and dive under the hanging wall to explore beyond, we designed a waterproof capsule for underground swimming. The water is always ice cold and illness may result from naked swimming in it." The most important caution, he says, is never to explore a cave alone.

These modern cave men explore for scientific purposes, bringing out data on caves and life in them—salamanders, crickets, flies, bats, rats, snails; one interesting find was a blind variety of beetle. In eastern caves are beautiful deposits of calcite, travertine and onyx; there are no valuable stones in caves.

The granite caves in the western North Carolina mountains are a strange phenomenon. By all the laws of science a granite cave should not exist, save where rocks topple over on each other. But these are fault caves.

"The most eerie thing in all 'caving,'" says Stephenson, "is the fall of water in the distance. It echoes and re-echoes through the brain, the tiniest drip sounding like a gigantic waterfall about to rush upon you. It is all because sound is so magnified in caves. Your heart in a close passage thunders like a trip-hammer. Caves indeed are eerie places."

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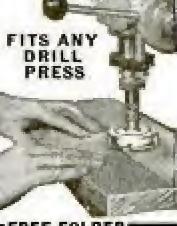
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Every Ounce Counts on a Clipper

(Continued from page 37)

equipment is placed on the plane. Passenger conveniences also may be added.

Pan American's maintenance men won a temporary victory recently when they found that much of the protective paint that covers the flying boats could be removed, replacing it with a coat of lanolin oil that could be sprayed on before each flight. The oil is just as good and weighs 90 pounds less. The six large United States flags painted on the hulls and wings weigh about five pounds.

An even greater victory was won when the original engines were replaced by more powerful ones. Although much heavier and requiring heavier propellers, the power plants more than paid for themselves because their reduced fuel consumption meant an overall saving of half a ton that is now devoted to carrying cargo.

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Before the war with Japan began, each flight crew crossed the Pacific and returned as a unit, either flying the 9,000 miles to Singapore in six legs or the 8,008 miles to Aukland, New Zealand, in four legs. The Singapore round trip took 14 days, then the crew spent four to five weeks at the Treasure Island base in San Francisco bay in training and ground duties before going

(Continued to page 187)



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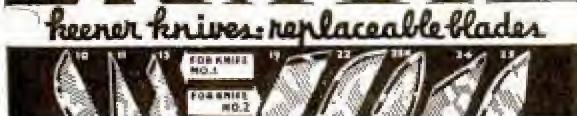
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out again. Meanwhile other crews kept up the schedule. The New Zealand run, started in 1940, is the only air route that crosses both the international date line and the equator.

To maintain these long runs Pan American established bases at Honolulu, at Midway, Wake, and Guam Islands, and at Manila for the transpacific run. Bases at Canton Island, the Fiji Islands, at Noumea in New Caledonia, and at Aukland were built for the New Zealand run. That means that besides operating airplanes the air line had to go into the construction business, the hotel and restaurant business, and even into vegetable gardening.

Canton Island, for instance, a barren coral atoll 2,000 miles southeast of Honolulu, was uninhabited until it was occupied jointly by American and British representatives. Pan American had to build its base from the ground up. Everything except sand for the concrete was brought in by ship for airplane fueling and servicing facilities, for the meteorology and radio offices, the hotel for passengers, and living quarters for its 34 employes. Radio masts, baseballs and bats, books and toothpicks are only a few of the thousands of items that had to be imported. Even standby apparatus for converting sea water into drinking water had to be provided, as well as collectors and reservoirs for conserving rain water.

111

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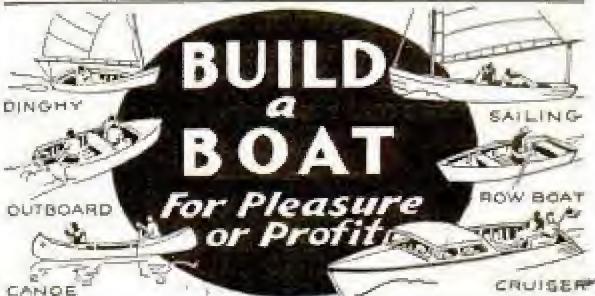


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L / 22 /

Flying "Spiders" on Guard

(Continued from page 11)

with canvas and digging a drain ditch around the area to carry away rain water.

Barrage balloons generally are of two different types, one called ballonet, the other dilatable. Balloons maintain their shape due to the excess of internal pressure over that of the outside atmosphere. This super-pressure must be high enough to prevent the force of the wind velocity from deforming the shape of the balloon. In the ballonet type, the lower portion of the balloon is an air chamber separated from the gas chamber. A wind scoop takes air into the air chamber, causing an internal pressure proportional to the wind velocity. In the dilatable type, rubber shock absorber cords permit the balloon to expand or contract as pressure changes.

Pride of the Goodyear Tire and Rubber Company, one of several concerns constructing the "spiders," is what the engineers call the "Strato Sentinel," which has a hydrogen capacity of 68,000 cubic feet, a ceiling of 15,000 feet and a tail from which six finlike lobes protrude. Made of rubberized cotton fabric, it is said to be the highest altitude barrage balloon ever built.

Another Goodyear balloon is the D-5, which has a 30,000 cubic-foot capacity, a 7,500-foot ceiling and is made of synthetic rubber cloth of cotton impregnated with black gum that gives it a dark appearance. It has four lobes which are given a fluted appearance by elastic cords. When gas in the fins expands as the balloon rises, the lobes swell into smooth contour.

A third balloon, especially designed for the Navy's use, is a 5,500 cubic-foot bag designed for altitudes of 3,000 to 4,000 feet. Small balloons of this type are useful to the army, also, for preventing enemy strafing of moving columns of troops. They can be transported by trucks, carried beneath bridges and raised speedily to 1,500 feet.

Regarding the effectiveness of the balloon barrage, Major General J. A. Green, Chief of the Coast Artillery, says: "Barrage balloons are considered by military authorities as ideal for added protection of the locks of the Panama Canal, the Welland Canal and the Sault Ste. Marie. These are small targets. To be assured of obtaining hits, low flying or dive bombing is nec-

(Continued to page 190)



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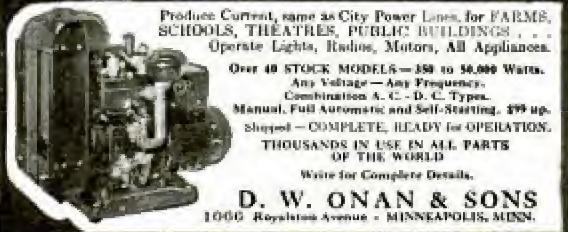
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essary. The balloons prevent this. If they are used in sufficient numbers, they force the enemy to fly at such a height that the bombardier's chance of registering a hit, even if he safely weathers antiaircraft fire, are immeasurably less than they would be were he free to approach close to the locks before releasing his bombs.

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"Take, for instance, New York and Boston. To ring them completely with antiaircraft artillery would require a tremendous amount of costly equipment, but to cover certain areas with the less costly balloons and other areas with antiaircraft artillery would simplify the task and still provide a strong defense.

"During recent months numerous reports from European sources have been carefully studied in the War Department. Some of these reports tell of the number of German aircraft that have come in collision with the British balloon cables. The usual result has been that the plane has crashed or has been forced to land in enemy territory.

"We do not know yet all of the situations under which it will be practical to use barrage balloons to advantage. These problems are being studied intensively. One problem that is receiving very careful study relates to the close coordination that must be effected between the employment of the barrage balloon and our own defending aircraft. You can appreciate the importance of such a study, for the balloon cable does not differentiate between friendly and enemy airplanes. Studies are also being made to determine how best to use the balloons with their supporting antiaircraft artillery."

Write to the firms listed in the Where-to-Buy-It index, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

Sections of Auto Tire on Board Provide Good Bicycle Rack



A good rack for bicycles can be made easily by nailing a number of auto tire sections to a support as indicated. The support is nothing more than a length of 2 by 4-in. stock nailed to a couple of posts, which extend above the ground to the correct height.

1490

Drug Helps Prevent Blood Clots After Operations

Two Swedish physicians, describing experiments with heparin, report that the substance helps prevent thrombosis after surgery, in which a clot or plug forms in a blood vessel or heart cavity and may cause prolonged disability or death. They gave the drug, which is known for its ability to prevent blood clotting, to 325 patients after surgery, and not one developed thrombosis. In 302 similar operations where heparin was not given, there were 33 definite cases of thrombosis and 15 others who experienced a rise in pulse rate and temperature indicating slight thrombosis. The physicians, Dr. Clarence Crafoord and Dr. Erik J. Jorpes, of Stockholm, said the 325 selected for heparin treatment were all over 35 years of age and had diseases which made thrombosis a hazard. Heparin exists naturally in the body and is obtained by an extraction process for medicinal use.

To learn where to buy commercial products described in these pages, see the index.

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WITTE ENGINE WORKS



On the Anti-Tank Firing Range

(Continued from page 15)

millimeters and 75's, in addition to heavy artillery. To a lesser extent the .50-caliber machine gun is effective against light tanks and lightly armored vehicles. It is the first gun an Infantry trainee uses on the anti-tank firing range.

At Camp Wheeler, Infantry Replacement Center near Macon, Ga., the new army is schooled in the elementary use of anti-tank guns.

The range is in a heavily wooded area. It has to be. The fire from .50-caliber guns creates a danger area 9,500 yards behind the targets. The range slopes up to a summit 700 yards away.

Down the line, instructors give the ready signal. Over a loud speaker a voice barks the firing orders. Then, on the slope, three small white objects start moving across the range. You take aim, your hand flicks the trigger, a tracer bullet streaks across the clearing toward its goal—you hope. If you're off, you hastily correct the error and bang away again.

Let's take a look at those targets. They measure $3\frac{1}{2}$ by 6 feet, about the size of the vital portion of a tank. There are three of them, one for each gun, and they move on tracks, the farthest at a constant distance of 700 yards, the nearest at 400 yards, and a middle target moving angularly between the others. Each target is drawn by an endless cable, driven from the rear axle of an old truck. Stripped to its chassis and set up in the control house, the truck can move the targets at 5 to 35 miles an hour.

The control house lies buried at the top of the slope, hidden from the firing line. Walled by one foot of steel-reinforced concrete, it is buffered ten feet ahead by an-

other two-foot wall of concrete, between which is enough sand to sink a dredge. This sandwich of concrete, steel, and sand will withstand the fire of seventy-fives.

The elevated control stand overlooks the line of machine guns, with a clear view of the targets. An officer, in telephone contact with the control house, sits before a microphone and issues orders to the gun crews. Noncommissioned officers behind the gunners see that orders are followed.

Soldiers are trained in the firing routine until it becomes automatic. When the control officer calls "Range!", they respond with the yardage on their target, simultaneously adjusting their guns to the correct range. "Tank!"—the description of the target—is the second order. As soon as the gunners repeat this, the command "One lead" or "Two leads" follows, according to the speed of the tank and its distance. The faster a tank goes, the greater the lead he has to take in advance of the target. Then comes "Track left!" or "Track right!", indicating the direction the targets will move. The last command is "Commence Firing!"

For weeks before the trainees are permitted to try their skill, they spend arduous hours on cardboard targets, using their imagination for ammunition. They learn the principles of firing the rifle, the pistol, the light machine gun, heavy machine gun, and mortars. They get the feel of a gun, become used to the shock of fire, acquire a sense of timing and distance and learn the construction and operation of each mechanism. When they finally go up for their turn on the anti-tank guns, they find the weeks of practice have not been in vain. They're pretty good marksmen.

Fighting at 50,000 Feet

(Continued from page 5)

2119A
react at high altitudes a program of pilot research is being carried on. Fliers already have to be supercharged or "de-nitrogenized" before a high flight. They must breathe oxygen and, if they leave the windows open to handle their guns, must wear electrically heated suits and gloves. At 30,000 feet a flier would become unconscious in less than a minute without oxygen and even with it he begins to suffer from the lack of pressure.

To work efficiently at 35,000 feet and even to exist much higher than that, the crew needs some sort of artificial pressure. A development of the pressure cabin, such as is used by the Boeing Stratoliner, may be a solution although then there is the hazard of a sudden drop in air pressure if the fuselage is ripped open by a lucky hit. Another possibility is that the men who fly at high altitudes may wear reinforced pres-

(Continued to page 194)



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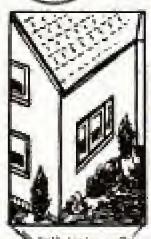
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Big "cats"—tracklaying tractors—lift 40-foot, 3/4-ton lengths of pipe into the trench and you shade your eyes from the white glare as "tackers" join the pipe ends with electric-arc welds stronger than the pipe itself. When a mile of line has been welded, each weld is coated with soapsuds and inspected for leaks as 120 pounds of air is forced into the pipe; then water under 900 pounds pressure tests the entire pipe.

To guard it against corrosion and abrasion in the soil, the pipe must be heavily coated; the New England line was enameled, then wrapped in asphalt-impregnated felt. Sometimes heavy paper is used. Automatic machines roll along the pipe wrapping and tarring it in one operation. In some soils electrolysis attacks the metal; engineers licked the problem by feeding a low current into the pipe. Wind generators are used on one Pure Oil company line in sections remote from power lines. Unattended, they do the job.

Pipe lines are built as straight as contours permit: under a New Hampshire golf course fairway, dipping under rivers, detouring around cities. Sometimes bends are made in the factory; often the pipe is "cold bent" at the site. One big "cat" will straddle the pipe, sit on it to hold it down while another loops a line under the pipe and lifts away, bending the 3/8-inch steel pipe to the desired contour.

To test the pipe wrapping, a hoop with wire brushes encircles the pipe and as it moves along, any bare metal encountered by the brushes is revealed by static on an electric dial. Before it is buried, the pipe is cleaned by a "go-devil" which clatters through under compressed-air drive, its rotating blades sweeping the tube.

Once covered with earth, the pipe is invisible save at pumping stations or where it emerges at rivers or swamps. There are eight pumping stations at 30-mile intervals on the New England line. The tendency, however, is to pump at higher pressures—some as high as 2,000 pounds are reported

(Continued to page 198)

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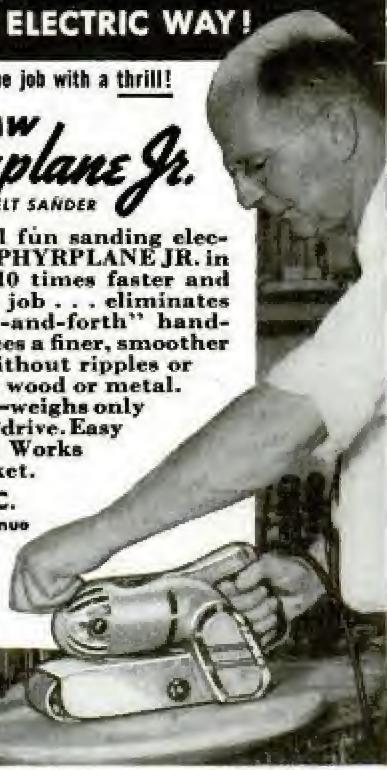
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You'll have real fun sanding electrically with ZEPHYRPLANE JR. in your shop. It's 10 times faster and easier on every job . . . eliminates tiresome "back-and-forth" hand-sanding. Produces a finer, smoother finish, too . . . without ripples or ridges. Ideal for wood or metal. Easy to handle—weighs only 9 1/2 lbs. Link belt drive. Easy to change belt. Works from light socket.

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	V	V-2	V-3
Hex	1/4"	5/16"	5/16"
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Thread Length	1/2"	7/16"	5/8"
Weight, Grams	8	11/2	2 1/2

Champion has designed 3 spark plugs for model gas engines which give the same dependable performance as regular Champions. Sillimanite sealed. Sillimanite insulator. Alloy needlepoint electrodes for easy starting. One piece construction.

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—and space the pumps farther apart. One of the longest jumps is 206 miles between two stations on the Wyoming pipe line.

With the pipe out of sight, extreme vigilance must be exerted to detect leaks. Over one southwestern line aerial inspectors make twice weekly tours, watching for the telltale blotch of black in the snow or the patch of dead vegetation that betrays oil leaking into the soil. Oil lines are operated much as a railroad, their dispatchers always in touch with pumping stations and terminals by private telephone systems paralleling the line. Constant check of the pressure at each point will tell of a break.

Low temperatures, naturally, slow down the movement of oil and call for higher pressures to keep the thicker crude flowing. New England's pipe line will encounter sub-zero temperatures, but the tankers bringing oil to Portland from the Gulf and Colombia will ride the warm Gulf Stream and thus be able to start the oil underground at almost the 80-degree temperature at which it was shipped.

Some interstate trunk lines handle shipments for several different producing or refining companies. The pipe must be kept filled and flowing at all times, a "slug" of Pure Oil gasoline, for example, following a shipment of Gulf's gasoline. The dispatcher notifies all switching points of the shipments, and a spot of dye about five feet long indicates the end of one "slug" and the beginning of another. On sizable quantities, the mixing of slugs is negligible.

The oil pipe line industry represents a billion dollar investment. A 12-inch pipe costs \$2 a foot, and fast crews have laid three miles a day. In 1940 pipe lines carried 939,732,000 barrels of crude oil—nearly 70 percent of the total produced—to refineries, and pumped 97,000,000 barrels, 15 percent of the total, of motor fuel back to market. River barges, ocean tankers, and railway tank cars do the rest. Movement by rail is most costly; pipe line transportation is 30 to 40 percent higher than by ship, but a submarine can't sink a pipe line, a bomber can't see it, and in these critical days industry and the army and the folks at home—particularly in the eastern states which consume around 40 percent of our petroleum and are unhappily far from the wells—figuratively pat the tarred back of the vast system of pipe lines and wish there were even more like them.

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TO MAKE THIS UNIQUE
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Car Owners: You are invited to make a gas saving road test with the Vacu-matic on your own car, with the absolute understanding that unless it proves to you that it will save you up to 30% on gas and improve your car performance, the test will cost you nothing. Investigate this remarkable discovery that trims dollars off gasoline bills—gives you worthwhile gas savings—more power—greater speed—quicker pickup—faster acceleration.

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In addition to establishing new mileage records on cars in all sections of the country, the Vacu-matic has proven itself on thousands of road tests and on dynamometer tests which duplicate road conditions and record accurate mileage and horse power increases.

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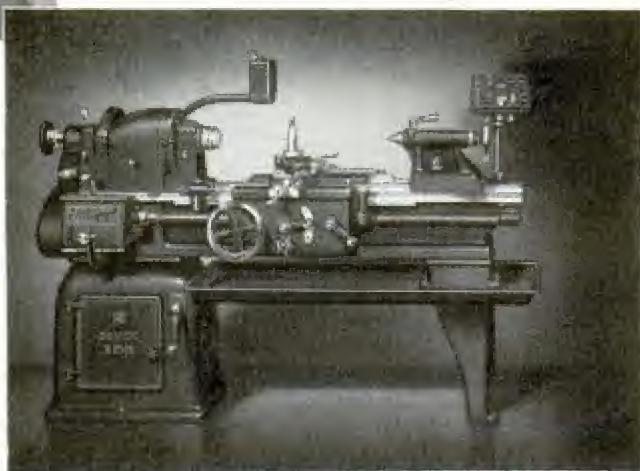
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South Bend 16" Toolroom Precision Lathe

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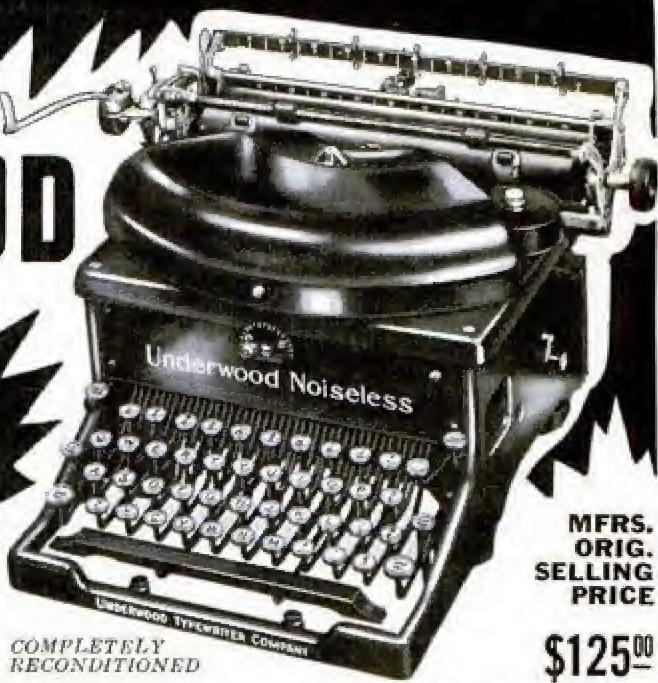


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